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Mariners Weather Log

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Front Cover: Raging seas surround the British oil rig TRANSWORLD 58 as she drifts in the North Sea after losing four of her eight anchors. The winds were reported as high as 78 kn and the seas near 40 ft. Wide World Photo.

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Mariners Weather Log

Editor: Elwyn E. Wilson

April-May-June 1982
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Washington, D.C.

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The Secretary of Commerce has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through June 30, 1982.

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Mariners Weather Log

EASTERN NORTH PACIFIC TROPICAL CYCLONES, 1981

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Tropical cyclone activity over the eastern North Pacific in 1981 began May 30 and ended October 30. Spanning 153 days, the season was ten days longer than the 1980 season. There were 17 tropical cyclones during the season, two more than in 1980. Eight of the 17 were hurricanes, seven were tropical storms, and two were depressions. Hurricane hours during the 1981 season totaled 432 compared with 586 in 1980. Tropical storm hours totaled 858 compared with 476 during the 1980 season. The highest sustained windspeed during the 1981 season was 110 kn, attained by hurricane Norma on October 10. Norma was the only hurricane during the 1981 season that had winds greater than or equal to 100 kn compared with three in 1980, four in 1979, and six in 1978. Table 1 shows the monthly distribution of 1981 tropical cyclone activity and tables 2 and 3 compare this activity with that of recent years. The 1966-81 period was chosen for comparison since it probably includes all tropical cyclone activity in the area due to the excellent satellite coverage since 1966. Prior to that time some tropical cyclone activity went undetected due to the sparsity of data in the Tropics. A summary of the important features of the 1981 season is given in table 4. Cyclone tracks are shown in figures 1 and 2.

Table 1.--Monthly distribution of eastern North Pacific tropical cyclones, 1981*

	May	Jun	Jul	Aug	Sep	Oct	Nov	Total
Tropical depressions	0	0	0	2	0	0	0	2
Tropical storms	1	0	2	1	1	2	0	7
Hurricanes	0	1	1	3	1	2	0	8
Total	1	1	3	6	2	4	0	17

*Cyclones are ascribed to the month in which they began

Table 2.--Frequency of eastern North Pacific tropical storms and hurricanes combined by months and years *

Year	May	Jun	Jul	Aug	Sep	Oct	Nov	Total
1966	0	1	0	4	6	2	0	13
1967	0	3	4	4	3	3	0	17
1968	0	1	4	8	3	3	0	19
1969	0	0	3	2	4	1	0	10
1970	1	3	6	4	1	2	1	18
1971	1	1	7	4	2	2	1	18
1972	1	0	1	6	2	1	1	12
1973	0	3	4	1	3	1	0	12
1974	1	3	3	6	2	2	0	17
1975	0	2	4	5	3	1	1	16
1976	0	2	4	4	3	1	0	14
1977	1	1	1	1	3	1	0	8
1978	1	3	4	6	2	2	0	18
1979	0	2	2	2	1	2	1	10
1980	0	3	5	2	2	2	0	14
1981	1	1	3	4	2	4	0	15
Total	7	29	55	63	42	30	5	231
Average	0.4	1.8	3.4	3.9	2.6	1.9	0.3	14.4

*Cyclones are ascribed to the month in which they began.

Table 3.--Number of eastern North Pacific tropical storms reaching hurricane intensity by months and years*

Year	May	Jun	Jul	Aug	Sep	Oct	Nov	Total
1966	0	1	0	4	2	0	0	7
1967	0	1	0	2	1	2	0	6
1968	0	0	0	3	2	1	0	6
1969	0	0	1	1	1	1	0	4
1970	1	0	1	1	0	1	0	4
1971	1	1	5	2	2	1	0	12
1972	1	0	0	6	1	0	0	8
1973	0	1	3	0	2	1	0	7
1974	0	2	2	4	2	1	0	11
1975	0	1	2	3	1	1	0	8
1976	0	2	1	2	3	0	0	8
1977	0	0	1	1	1	1	0	4
1978	1	2	3	4	1	1	0	12
1979	0	1	1	2	1	1	0	6
1980	0	2	2	2	1	0	0	7
1981	0	1	1	3	1	2	0	8
Total	4	15	23	40	22	14	0	118
Average	0.3	0.9	1.4	2.5	1.4	0.9	0	7.4

*Cyclones are ascribed to the month in which they began.

Eastern Pacific Hurricane Center forecasters issued 309 tropical cyclone advisories during the 1981 season compared with 270 in 1980. Advisories were issued on a regularly scheduled basis for cyclone positions at 0000, 0600, 1200, and 1800 GMT.

Although six tropical cyclones moved onshore during the 1981 season, damage and casualty reports were received from only two of them, tropical storm Lidia and hurricane Norma. At least 73 people lost their lives when tropical storm Lidia brought heavy rains and extensive flooding to the north-central Mexican coast between Los Mochis and Culiacan. Damage to homes, crops, and highways was estimated in excess of $60 million. Four days later and 200 mi to the southeast, hurricane Norma moved onshore near the coastal town of Mazatlan. Although Norma was more intense than Lidia, loss of life was kept to a minimum due to the advanced evacuation of 5,000 people. One fisherman was lost when his boat overturned and five of six soldiers guarding a government helicopter were washed away,

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Table 4.--Eastern North Pacific Tropical Cyclones, 1981. All times GMT, latitudes north, longitudes west. HU = hurricane, TS = tropical storm, TD = tropical depression.

Cyclone	Depression	Storm	Hurricane	Storm	Depression	Final Pos.	Max(kt)	From	To
TS Adrian	301800	311800			021200	040000	40	010600	011800
30 May-4 Jun	11.4-105.2	12.8-104.1			13.7-100.4	16.0-097.5		13.0-102.8	13.2-101.5
HU Beatriz	281800	290600	301800	030600	041200	041800	75	011200	021800
28 Jun-4 Jul	11.4-103.4	11.7-105.4	15.2-110.4	20.4-117.6	24.5-121.2	25.5-121.5		16.1-112.9	19.2-116.2
TS Calvin	041800	051200			081800	090000	45	051800	060000
4-9 Jul	13.4-102.4	13.9-104.8			21.6-109.5	21.6-110.3		14.3-105.7	15.0-106.0
HU Dora	101800	110600	130000	151800	161800	161800	80	141600	150600
10-16 Jul	13.3-106.9	13.7-108.0	15.1-113.1	18.8-125.8	19.4-129.8	19.4-129.8		17.4-120.9	17.9-123.7
TS Eugene	161800	180600			201200	211800	45	190000	200000
16-21 Jul	17.5-106.6	17.6-110.8			20.2-119.7	21.4-126.0		18.1-112.7	19.7-116.8
TD Six	041800					051800	30	041800	051800
4-5 Aug	16.0-121.0					18.0-125.7		16.0-121.0	18.0-125.7
HU Fernanda	061200	070600	090600	111800	121200	130000	90	101800	110600
6-13 Aug	12.0-104.6	12.2-109.6	14.9-122.0	21.8-135.7	23.7-137.9	24.3-138.7		17.8-130.6	19.8-133.2
HU Greg	130600	141800	200600	201800	211800	221800	65	200600	201800
13-22 Aug	16.2-111.4	17.7-114.2	18.0-138.7	18.5-139.8	18.7-142.9	17.3-147.2		18.0-138.7	18.5-139.8
TD Nine	191800					200600	30	191800	200600
19-20 Aug	19.7-111.7					19.6-113.0		19.7-111.7	19.6-113.0
HU Hilary	212015	220000	251200	261800	271800	281800	75	251800	260600
21-28 Aug	17.7-107.7	18.2-108.0	20.7-115.8	21.7-122.7	21.0-126.3	20.2-130.0		21.0-117.1	21.7-120.2
TS Irwin	271800	281800			300000	310600	45	281800	290600
27-31 Aug	16.5-103.5	19.1-105.5			22.5-108.5	24.2-113.0		19.1-105.5	20.5-106.7
HU Jova	141200	141800	151800	181200	201800	210000	75	170000	171200
14-21 Sep	14.5-123.4	14.6-124.6	14.9-129.3	19.7-140.0	22.5-157.0	23.3-158.5		16.7-133.3	18.0-135.0
TS Knut	190000	190600				211200	55	200600	210000
19-21 Sep	15.5-104.5	15.8-106.0				23.3-107.0		18.6-109.9	21.6-109.4
TS Lidia	061800	070000				080600	45	070000	071200
6-8 Oct	19.5-110.0	20.4-109.5				26.0-109.0		20.4-109.5	22.6-109.5
TS Max	071800	080600			100000	101800	45	090600	091200
7-10 Oct	15.1-115.4	15.6-116.1			18.3-117.9	18.9-118.3		17.3-117.2	17.6-117.5
HU Norma	081800	090600	091800			121200	110	101800	110600
8-12 Oct	14.5-104.5	15.2-105.8	16.3-106.6			23.7-106.5		17.8-108.2	19.0-108.7
HU Otis	240000	241800	261200	291200		300000	75	261800	270600
24-30 Oct	10.7-098.8	11.4-102.0	14.0-101.9	20.7-105.9		22.5-105.8		14.0-101.9	14.2-102.2

along with the helicopter, in a flash flood. Crop and cattle losses alone were estimated in excess of $24 million.

Although some ships passed close to the centers of tropical cyclone activity and undoubtedly experienced heavy weather and seas, no reports of casualties or damage were received.

The National Satellite Service Field Station, collocated with the Eastern Pacific Hurricane Center (EPHC), provided excellent satellite coverage. Visual and infrared satellite imagery was available from the GOES and NOAA satellites. Movie loops of past years were replaced in 1981 by the Satellite Image Display System (SIDS), providing continuous surveillance of tropical cyclone activity. The detail on satellite imagery was excellent. One-half nautical mile sector resolution was made available on request. Cyclonic intensity was calculated using the Dvorak technique of satellite analysis.

No reconnaissance flights were made into eastern North Pacific tropical cyclones during the 1981 season. However, U.S. Air Force aircraft were placed on standby status when hurricane Beatriz posed a threat to the west coasts of Baja and Southern California.

Although satellite imagery continues to improve and is probably one of the most important tools used by tropical forecasters, aircraft reconnaissance and synoptic ship reports retain their importance as invaluable comparative observations for both the tropical forecaster and satellite meteorologist.

Four numerically generated forecast tracks for tropical cyclone activity in the eastern North Pacific were available from the National Hurricane Center in Miami during the 1981 season. Table 5 shows the average forecast errors for the 24, 48, and 72 hr positions for the EPHC forecasters and each of the numerical models. While the numerical forecasts are independent of each other, the forecasts made by the EPHC forecaster are not independent of the numerical forecasts. The average forecast error for the numerical models through 72 hr totaled 184 mi compared with 182 mi for the EPHC forecasters.

Table 5.--Forecast errors *

	Forecast period (hours) 24	48	72
EPHC forecasters	196/100	131/178	82/267
EPANALOG	184/99	135/185	87/261
EPHC77	178/101	133/195	85/270
CLIPER	186/104	137/194	88/266
EPHC81	78/104	59/186	36/242

*Number of cases/average error in nautical miles.

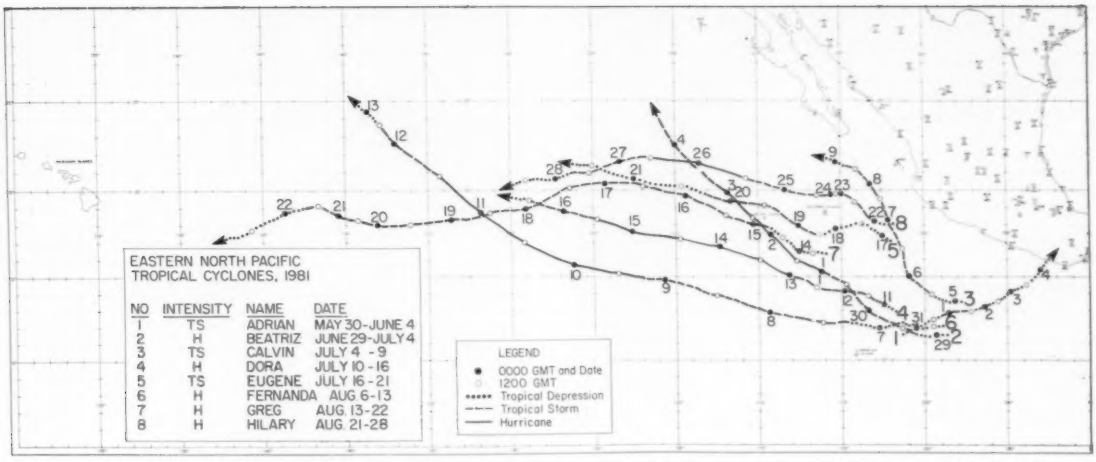

Figure 1.--Tracks of Eastern North Pacific tropical cyclones 1 through 8, 1981.

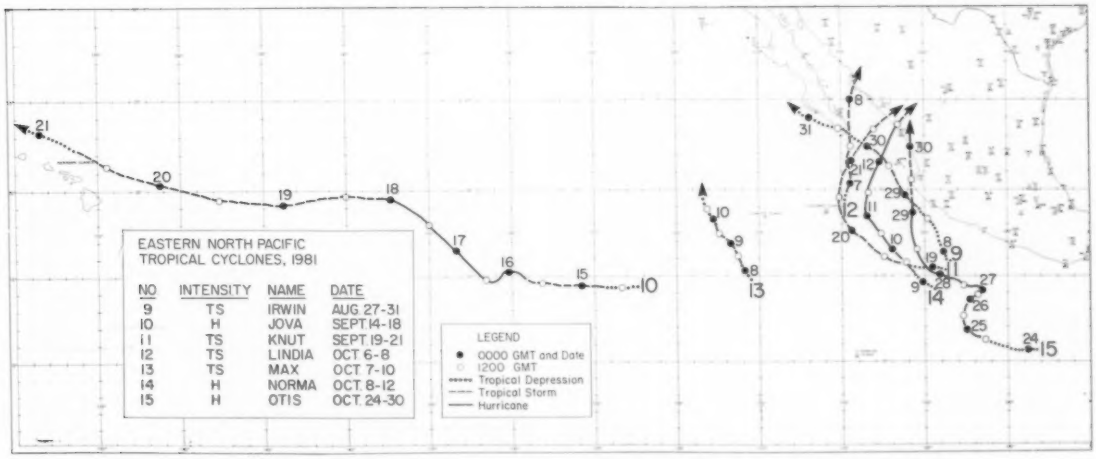

Figure 2.--Tracks of Eastern North Pacific tropical cyclones 9 through 15, 1981.

Only named tropical cyclones are described in the following paragraphs. Hurricanes Greg and Jova continued into the central North Pacific.

TROPICAL STORM ADRIAN, MAY 30 - JUNE 4

A large area of intense thunderstorm activity 240 mi east-northeast of Clipperton Island spawned the first tropical cyclone of the 1981 season on May 30. Drifting east-northeastward over 85°F water, the cyclone began to intensify under the northwest side of an upper level high pressure area centered off the southern coast of Mexico. Within 24 hr winds near the center had increased to 35 kn, and the cyclone was upgraded to tropical storm Adrian near 12.8°N, 104.1°W at 1800 May 31. Winds reached their maximum intensity of 40 kn as the storm moved across a pocket of 86°F water on June 1. Continuing on an east-northeasterly track, the cyclone drifted from the warmer water toward cooler 82°F water and began to weaken. By 1200 June 2 winds were down to 30 kn, and Adrian was downgraded to a depression near 13.7°N, 100.4°W. The cargo ship ANDROMEDA and passenger liner SANTA MARINNA provided helpful observations. By 0000 June 4 the cyclone was 40 mi off the southern Mexican coast near 15.4°N, 97.9°W. The cargo ship STAR WORLD, 30 mi to the south, was helpful in locating the center. Adrian turned north-northeast and moved into the Mexican coast.

HURRICANE BEATRIZ, JUNE 28 - JULY 4

The second cylone of the season began as a depression 350 mi east of Clipperton Island on June 28. Moving westward over 84°F water, the cyclone began to intensify slowly. By 0600 June 29 winds had increased to 35 kn, and the cyclone was upgraded to tropical storm Beatriz near 11.7°N, 105.4°W. Turning northwestward, the cyclone passed 210 mi north of Clipperton Island, and her winds near the center increased to 65 kn by 1800 June 30, and Beatriz was upgraded to a hurricane. Beatriz passed 210 mi south of Socorro Island late on the

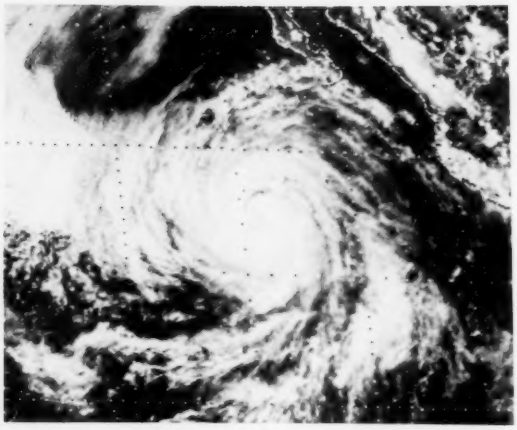

Figure 3.-- Hurricane Beatriz with 75-kn winds near 17°N,114°W at 2315 July 1.

30th. The cyclone turned to the northwest toward an upper level trough of low pressure off the west coast of Baja California. With vertical wind shear near zero and a sea-surface temperature near 82°F, the cyclone continued to intensify. Winds reached a maximum intensity of 75 kn by 1200 July 1. Figure 3 shows Beatriz with 75 kn winds at 2315 July 1 near 17.2°N, 114.1°W. Beatriz passed 30-mi southwest of Clarion Island on July 2, and the winds began to slowly decrease as the cyclone began to move over cooler water. At 0600 July 3 Beatriz was downgraded to a tropical storm near 20.4°N, 117.6°W. Twenty-four hr later Beatriz was downgraded to a tropical depression over 72°F water near 24.5°N, 121.2°W. The OCEAN HIGHWAY, JUKO MARU, TOYOTA MARU NO. 15, and JOHN LYKES were helpful in locating Beatriz. The final advisory on the cyclone was issued at 1800 July 4.

TROPICAL STORM CALVIN, JULY 4-9

The next cyclone, tropical storm Calvin, began as a tropical disturbance 250 mi south of Acapulco on July 3. Moving west-northwestward the disturbance intensified and was upgraded to a depression on July 4. By 1200 July 5 the depression was upgraded to tropical storm Calvin with 40-kn winds near 13.9°N, 104.8°W. Six hr later the storm reached its maximum intensity of 45 kn. The cyclone now turned north-northwestward around the southwest side of an upper level HIGH centered over extreme northwestern Mexico. The TOYOTA MARU NO. 16, JOHN LYKES, WOKO MARU, and MOBIL ARCTIC were in the area and transmitted observations. By 1800 on the 8th his winds were down to 30 kn, 85 mi south-southeast of Cabo San Lucas on the tip of Baja California. Calvin then turned westward, and the center dissipated 85 mi south of Baja California. Observations from the NEDLLOYD BANGKOH and KISO MARU helped locate Calvin on the 8th and 9th.

HURRICANE DORA, JULY 10-16

A weather report from the cargo ship YAMAZURU MARU helped confirm satellite information in identifying and locating the next cyclone of the season on July 10. Drifting west-northwestward, the cyclone intensified over 83°F water and was upgraded to tropical storm Dora near 13.7°N, 108.0°W on the 11th. Winds were 45 kn as the cyclone passed 220 mi north of Clipperton Island. By 0900 GMT July 12 Dora, with 55-kn winds, was 250 mi south of Socorro Island. Winds increased to 65 kn hurricane force by 0000 on the 13th. The ship AMSTELMOLEN, sailing within 25 mi of Dora's center, reported 65-kn winds, 29-ft seas, and a barometric pressure of 981.8 mb. By 0000 GMT July 14, Dora was near 16.8°N, 117.2°W. The hurricane tracking westward continued to intensify, and her winds reached their maximum intensity of 80 kn on the 14th near 17.4°N, 120.9°W (fig. 4). Dora turned west-northwestward again on the 15th and weakened over 76°F water. With 55-kn winds she was downgraded to a tropical storm near 18.8°N, 125.8°W late on the 15th. Weather reports from the AMSTELMOLEN continued to help locate the center of Dora through the final advisory on the cyclone on the 16th.

Figure 4.-- Hurricane Dora has 80-kn winds at 1815 July 14, near 17°N,121°W.

TROPICAL STORM EUGENE, JULY 16-21

An area of intense thunderstorm activity off the central Mexican coast on the 16th generated the 5th cyclone. Moving west-northwestward, the cyclone intensified over 85°F water. The COLUMBIA STAR was radioing observations. The cyclone was upgraded to tropical storm Eugene on the 18th near 17.6°N, 110.8°W. The storm turned westward and passed 70 mi south of Socorro Island. Eugene reached his maximum intensity of 45 kn on the 19th, which continued for the next 18 hr then began to diminish. By 1200 on the 20th his winds were down to 30 kn near 20.2°N, 119.7°W. Low clouds moving into the cyclonic circulation from the west further weakened the cyclone, and the final advisory was issued on July 21.

HURRICANE FERNANDA, AUGUST 6-13

Fernanda began as a depression near 12.0°N, 104.6°W. The OCEANIA MARU provided valuable obser-

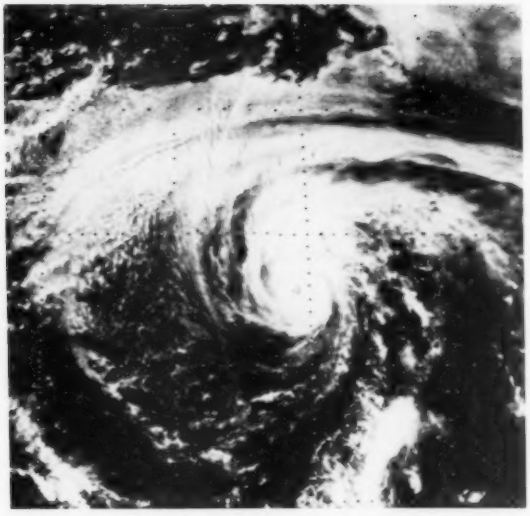

Figure 5.-- Hurricane Fernanda has a well-developed eye and 90-kn winds near 18°N, 131°W at 1815 August 10.

vations on the initial analysis. Moving rapidly westward, the cyclone passed 110 mi north of Clipperton Island early on the 7th. Winds of 35 kn at that time resulted in tropical storm Fernanda. With sea-surface temperatures near 85°F, Fernanda continued to intensify. At 0600 on the 9th winds reached 65 kn, and the storm was upgraded to a hurricane at 14.9°N, 122.0°W. Fernanda, with a well-developed eye, reached its maximum intensity of 90 kn near 17.8°N, 130.6°W at 1800 on the 10th (fig. 5). Fernanda turned northwestward toward colder water and by 1800 on the 11th the cyclone was down to 60 kn and downgraded to a tropical storm ne : 21.8°N, 135.7°W. Winds continued to diminish as the cyclone moved northwestward and low-level clouds entered into the cyclonic circulation. The storm was a depression on the 12th and dissipated near 24.3°N, 138.7°W on the 13th.

HURRICANE GREG, AUGUST 13-22

An area of intense thunderstorm activity moved westward from the southern Mexican coast and produced the next cyclone 160 mi south of Socorro Island. The cyclone intensified over 84°F water and was upgraded to tropical storm Greg near 17.7°N, 114.2°W on August 14. The NORDLAND V was helpful in locating the storm. Moving at 10 kn around the southwestern side of an upper level HIGH, Greg continued on a west-northwesterly track, passing 30 mi south of Clarion Island at 2100. Accelerating to 16 kn, Greg had 50-kn winds by the 16th. Greg then turned westward, then west-southwestward for 24 hr before turning west again near 18.8°N, 130.3°W. Greg began to slowly intensify and was upgraded to a hurricane with 65-kn winds near 18.0°N, 138.7°W at 0600 August 20. Weather reports from the CHIBA were very helpful in an area of sparse observations. Greg now turned west-northwestward, crossing 140°W and into the Central Pacific Hurricane Center's (CPHC) area of responsibility at 2100 on August 20. After crossing 140°W, Greg turned west-southwestward and began to weaken over 78°F water. The final advisory was issued by the CPHC at 1800 on the 22nd. See the following article by the CPHC.

HURRICANE HILARY, AUGUST 21-28

A report from the cargo ship AQUAFAITH confirmed satellite imagery in locating the next cyclone near 17.7°N, 107.7°W. By 0000 on the 22d, winds near the center had increased to 35 kn, and tropical storm Hilary was born near 18.2°N, 108.0°W. Moving northwestward, then westward over 82°F water, Hilary passed 50 mi north of Socorro Islands at 0600 August 24. By 1800 he had a well defined eye. Observations from the OGDEN JORDAN, OVERSEAS MARILYN, WINTER WATER, TOYOTA MARU NO. 17, METEOR, SCANDINAVIAN HIGHWAY, DUBROVNIK, and BUNKO MARU were invaluable between the 22d and 24th. Hilary then turned west-northwest, with the winds increasing to 70 kn and hurricane status near 20.7°N, 115.8°W at 1200 on the 25th, with a maximum of 75 kn at 1800 (fig. 6). Twenty-four hr later the winds were down to 50 kn, and in another 24 hr the storm was downgraded to a depression near 21.0°N, 126.3°W. The final advisory was issued at 1800 on the 28th.

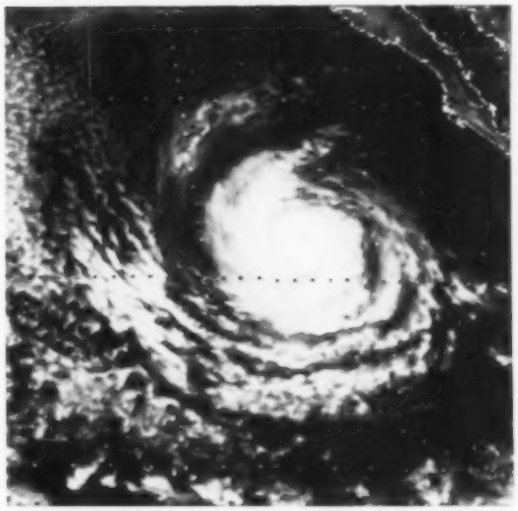

Figure 6.-- Hurricane Hilary at 1816, August 25 with 75-kn winds near 21°N,117°W.

TROPICAL STORM IRWIN, AUGUST 27-31

Irwin began as a tropical depression 215 mi west of Acapulco at 1800 on August 27. Moving northwest over 85°F water, the cyclone began to intensify. By 1800 on the 28th the winds had increased to 45 kn, and tropical storm Irwin was near 19.1°N, 105.5°W. The cargo ship AMERICAN CORSAIR, 25 mi to the north, reported northeasterly 40-kn winds and 14-ft seas. The storm passed within 30 mi of the central Mexican coast and began to weaken over 82°F water. By 0000 on the 30th the winds were down to 30 kn, and the storm was downgraded to a depression 70 mi southeast of the tip of Baja California. Irwin now turned west-northwestward

and crossed the tip of Baja 40 mi south of La Paz between 0800 and 1500. After moving offshore, the cyclone turned westward and began to weaken over 79°F water. The final advisory was issued at 0600 on the 13th. The AMERICAN LIBERTY and YOUNG SPLENDOUR contributed helpful observations.

HURRICANE JOVA, SEPTEMBER 14-21

It was 2 wks before the next cyclone began as a tropical depression near 14.5°N, 123.4°W. Moving west over 85°F water, the depression was upgraded to tropical storm Jova at 1800 on the 14th near 14.6°N, 124.6°W. An eye was visible on satellite pictures, and the storm was upgraded to a hurricane at 1800 September 15 near 14.9°N, 129.3°W. Jova intensified to a maximum of 75 kn at 0000 on the 17th. Winds remained at 75 kn for 6 hr, then began to diminish as Jova accelerated toward colder water. Jova turned west-southwest and was downgraded to a tropical storm near 19.7°N, 140.0°W at 1200 September 18. Turning westward into the CPHC area of responsibility, Jova accelerated to 18 kn. The storm continued to weaken and was downgraded to a depression on the 20th. See the following article on Central North Pacific storms by the CPHC.

TROPICAL STORM KNUT, SEPTEMBER 19-21

As Jova was being downgraded to a tropical storm, the next cyclone began as a disturbance 190 mi south-southwest of Acapulco at 1200 September 18. Moving west-northwestward over 84°F water, the disturbance began to intensify. By 0600 on the 19th the winds had increased to 35 kn and the depression was upgraded to tropical storm Knut near 15.8°N, 106.0°W. Accelerating to 15 kn, over 86°F water, Knut continued to intensify. By 1800 on the 19th the storm, with 50-kn winds, was near 16.7°N, 108.8°W. Knut then turned north-northwest and reached its maximum intensity of 55 kn 50 mi east of Socorro Island at 0600 on the 20th. The storm then turned toward the north around the west side of an upper level HIGH centered over Mexico. By late on the 20th the 55-kn storm was near 20.8°N, 110.6°W and turned sharply to the northeast between high pressure aloft over central Mexico and a weak upper level trough off the northern coast of Baja California. Knut passed 90 mi southeast of the tip of Baja California and weakened. Weather reports from the ships YSI TRADER, ISLAND PRINCESS, and SAN FRANCISCO helped locate Knut as the storm moved toward the Mexican coast. The final advisory was issued at 1200 on the 21st with the center about 20 mi off the coast. Knut moved onshore with 40-kn winds 30 mi northwest of Mazatlan.

TROPICAL STORM LIDIA, OCTOBER 6-8

Two weeks passed before the next cyclone began as a tropical depression near 60 mi northeast of Socorro Island at 1800 October 6. Moving north-northeastward at 11 kn, the depression intensified rapidly and was upgraded to tropical storm Lidia with 45-kn winds near 20.4°N, 109.5°W at 0000 on the 7th. Lidia then turned northward toward strong southwesterly flow aloft over northwestern Mexico. Winds near the center remained at 45 kn for another 6 hr, then began to weaken as the storm moved over 80°F water. Weather reports from the ships ADRIAN MAERSK, YASHIMA MARU, TOYOTA MARU NO. 17, and PACIFIC PRINCESS were valuable in the analysis of Lidia as the storm moved toward the tip of Baja California. Lidia moved along the eastern shore of the tip of Baja California (fig. 7) between 1500 and 1700 on the 7th. By 0000 on the 8th Lidia was 50 mi northeast of La Paz. The cyclone, with 35-kn winds, moved onshore 20 mi south of Los Mochis, Mexico, at 0300 on the 8th. At least 73 people lost their lives along the coast between Los Mochis and Culiacan. Damage was estimated in excess of $60 million.

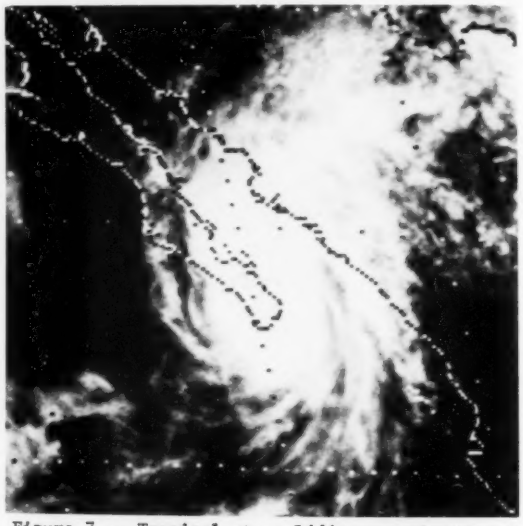

Figure 7.-- Tropical storm Lidia over the tip of Baja California at 1715 October 7.

TROPICAL STORM MAX, OCTOBER 7-10

As Lidia moved past the tip of Baja California the next depression was found near 15.1°N, 115.4°W. The cyclone intensified over 84°F water. By 0600 October 8 the winds had increased to 35 kn and the depression was upgraded to tropical storm Max near 16.5°N, 116.5°W at 1800. Max turned northwestward and reached his maximum intensity of 45 kn near 17.3°N, 117.2°W at 0600 on the 9th. The winds began to decrease as the cyclone moved over 81°F water. By 0000 on the 10th Max's winds had diminished to 30 kn, and the storm was downgraded to a depression near 18.3°N, 117.9°W. The final advisory was issued at 1800.

HURRICANE NORMA, October 8-12

Twelve hr after Max became a tropical storm the next cyclone was beginning to develop near 14.5°N, 104.5°W. The depression moved west-northwestward, then northwestward, and intensified over 83°F water. By 0600 October 9 the winds near the center had increased to 45 kn, and the cyclone was upgraded to tropical storm Norma near 15.2°N, 105.8°W. She had a well-defined eye visible on satellite pictures by 1415. By 1800 the winds had reached 65 kn hurricane force near 16.3°N, 106.6°W. A weather report from the cargo ship OCEANIA MARU, 75 mi to the north, confirmed other data on the

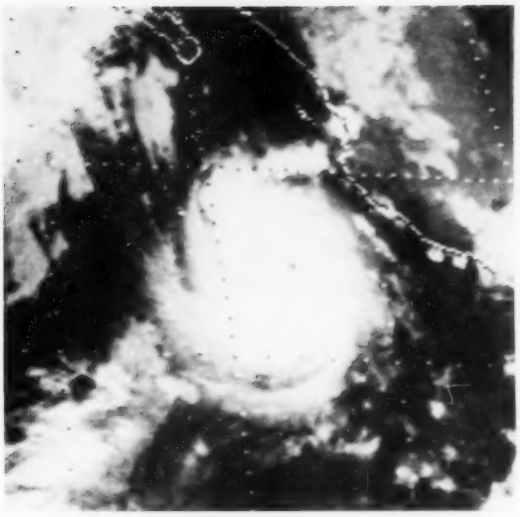

Figure 8.-- Infrared image of hurricane Norma showing a well-developed eye with 100-kn winds near 17°N, 108°W at 1215 October 10.

hurricane. Norma continued rapidly intensifying, reaching its maximum of 110 kn near 17.8°N, 108.2° W at 1800 October 10 (fig. 8). The cyclone continued to move northwestward for another 6 hr, then turned northward toward strong southwesterly flow aloft over northwestern Mexico. She passed 130 mi east of Socorro Island and 12 hr later turned north-northeastward. With winds of 90 kn, Norma accelerated toward the Mexican coast. The hurricane moved onshore 25 mi north-northwest of Mazatlan at 1000 on the 12th. The final advisory was issued at 1200 with the center beginning to dissipate about 40 mi north of Mazatlan. Advanced evacuation of 5,000 people kept loss of life to a minimum. One fisherman and 5 soldiers guarding a helicopter died. Crop and cattle losses alone were estimated in excess of $24 million.

HURRICANE OTIS, OCTOBER 24-30

The seventeenth and final cyclone of the 1981 season began as a depression near 10.7°N, 98.8°W at 0000 October 24. By 1800 the winds had increased to 35 kn, and the depression was upgraded to tropical storm Otis near 11.4°N, 102.0°W. The cyclone turned north-northwestward and by 1200 on the 25th the center was near 12.8°N, 102.7°W with 50-kn winds. Otis then turned north-northeastward, reaching 14.0°N, 101.9°W by 0600 on the 26th, and for the next 18 hr Otis showed little movement while winds near the center steadily increased. The storm was upgraded to a hurricane with 65-kn winds at 1200. Winds reached maximum intensity of 75 kn by 1800. Weather reports from the passenger liner PACIFIC PRINCESS were very helpful during this period. After 0000 on the 27th Otis began to move toward the west-northwest. The tanker TONSINA reported 45-kn winds and 21-ft seas. Turning northwestward, then northward, Otis passed 8 mi west of Cabo Corrientas on the central Mexican coast. As Otis moved northward his winds began to diminish. By 1200 on the 29th they were down to 50 kn, and he was downgraded to a tropical storm 35 mi west of Puerto Vallarta. Weather reports from the ships FRANCE MARU and SANTA MAGDALENA were helpful in locating Otis as the cyclone moved northward along the Mexican coast. The final advisory was issued at 0000 October 30 with the center moving onshore and dissipating 50 mi southeast of Mazatlan.

Mariners Weather Log

CENTRAL NORTH PACIFIC TROPICAL CYCLONES, 1981

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The Central Pacific had another quiet season. Two storms, Greg and Jova, formed in the Eastern North Pacific and moved westward into the Central Pacific Hurricane Center's (CPHC) area of responsibility (table 6).

Table 6.--Central North Pacific Tropical Cyclone Data, 1981[1]

Name	Dates	Maximum class	Maximum sustained winds (kn)	Lowest pressure(mb)	Total hrs observed
Greg	Aug 20-22	Tropical storm	E45 (NESS)	N/A	18(TS), 30(TD)
Jova	Sep 18-20	Tropical storm	E50 (NESS)	N/A	48(TS), 12(TD)

Total hours observed per class:

TS - 66
TD - 42

Key: TS - Tropical storm
TD - Tropical depression

[1]Data pertains only to period storm was in the central Pacific.

TROPICAL STORM GREG - AUGUST 20-22

Greg was born tropical depression 8 off the coast of Mexico near 16°N, 112°W, on August 13, 1981. The Eastern Pacific Hurricane Center (EPHC) issued its first bulletin at 13/0900. At that time the depression had maximum sustained winds estimated at 30 kn. It was upgraded to a tropical storm and named Greg on the 14th at 1800 with maximum sustained winds of 40 kn. Greg followed a westerly course for several days and maintained tropical storm intensity.

As he approached 140°W, he intensified and became a hurricane at 20/0600. His life as a hurricane was short. He moved under strong upper level southwesterlies and the resulting shearing action caused him to weaken rapidly. Greg was downgraded to a tropical storm at 20/1800, just

prior to crossing 140°W (fig. 1).

The first bulletin by the CPHC was issued at 21/0300. Greg continued to weaken and was downgraded to a tropical depression at 21/1800. Greg maintained a well-defined circulation for another 24 hr (fig. 9). The CPHC issued 8 advisories on the storm, with the last bulletin issued at 22/2100. There were no reports of damages or casualties to ships.

Figure 9.-- Tropical depression Greg near 18°N, 143°W at 2215 on the 21st with a well-defined low-level circulation.

TROPICAL STORM JOVA - SEPTEMBER 18-20

Jova began as tropical depression 12 on September 14, 1981. The EPHC issued its first bulletin at 14/1200. It intensified rapidly and was upgraded to a tropical storm and named Jova at 14/1800. Jova continued to strengthen and reached hurricane intensity 24 hr later at 15/1800. From her birth to the time she reached hurricane intensity, Jova moved in a westerly direction. Between 15/1800 and 16/0000, the storm took a northerly track and moved toward the west-northwest, reaching a maximum intensity of 75 kn.

As Jova approached 140°W, she began to weaken and turned toward the west again (fig. 2). Jova was downgraded to a tropical storm at 18/1200 and passed to the CPHC. CPHC issued its first bulletin at 18/2100. Jova continued to weaken over the next 48 hr while moving westward at 15 to 18 kn. As she approached 150°W, an upper level trough and a rapidly moving midlatitude LOW north of the Hawaiian Islands began to lend their influence to the storm's movement, and the storm began to move toward the west-northwest (fig. 10). As a tropical storm, Jova passed within 90 mi of the island of Hawaii at 20/1200. She was downgraded to a depression at 20/1800. The track brought her within 60 mi of the eastern coasts of Maui, Molokai, and Oahu. During this period she deteriorated rapidly, and the final bulletin by CPHC was issued at 21/0300.

Figure 10.-- Jova was a tropical storm at 2348 on the 19th near 19°N, 144°W .

Jova's positions and intensities while in the CPHC's area were determined almost entirely by satellite fixes and estimations using Dvorak's techniques. However, as Jova neared the Hawaiian Islands the SUGAR ISLANDER at 20/0000 reported winds of 090° at 35 kn, 135 mi northwest of the storm's center. At 20/0600 the same ship reported winds of 050° at 35 kn 125 mi north of the center.

The CPHC issued 10 advisories on the storm. There were no reports of damages or casualties to ships.

In view of the rapid speed of movement (about 50 percent higher than normal) that Jova moved through the CPHC area, the CPHC 24-hr error of 81.1 mi was extremely gratifying. Climatologically, systems moving through the same area that Jova did average 10 kn.

Mariners Weather Log

ICE OBSERVATIONS ON THE CHESAPEAKE BAY 1977-1981

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The winters of 1977-81 were unusually cold in the northeastern United States and in the Chesapeake Bay area. Abnormal atmospheric circulation patterns displaced cold polar air to the south, and as a result, the Chesapeake Bay experienced greater than normal icing conditions during these 5 yr. The winter of 1977 will be remembered as one of the coldest and iciest on record in the Chesapeake Bay area (fig.11). The extreme ice cover conditions were a result of unusually cold temperatures that prevailed from late October through the middle of February. The winter of 1978 did not experience the same degree of record breaking cold as occurred a year earlier, but temperatures were consistently below normal from late December through early March. The ice was extensive in the bay, but not nearly as severe as in the preceding year. This was the first time since 1917 and 1918 that two consecutive extremely cold winters occurred in the Chesapeake Bay area. The winter of 1979 was generally more temperate in the Chesapeake Bay area than the 2 previous yr. However, because February was so extremely cold, the ice cover extent was

Figure 11.--Map of Chesapeake Bay Area.

again much greater than normal. The winter of 1980 was the mildest of the 5 yr period (1977-81), but cold weather during February and early March again resulted in icy conditions in the upper Chesapeake Bay. The winter of 1981 was similar to that of 1977 inasmuch as bitter cold weather occurred during most of December and January, but the cold weather did not persist as long in 1981 as in 1977, and thus, the ice conditions were not as severe.

Satellite surveillance is probably the best means to gather synoptic ice data over a body of water the size of the Chesapeake Bay. Studies have demonstrated the ability of satellites to observe various ice features. In this study, high resolution Landsat satellite imagery was used to observe ice conditions for 5 different yr in the Chesapeake Bay. The three Landsat satellites were launched in July 1972, January 1975, and March 1978. Images are taken at an altitude of about 555 mi (905 km) and each image covers approximately 10,000 sq mi (16,000 sq km). The spatial resolution is 260 ft (80 m). Images are taken in three separate visible wavelength bands (μm = micrometers), (0.5 - 0.6 μm, 0.6 - 0.7 μm, and 0.7 - 0.8 μm) and one near infrared wavelength band (0.8 - 1.1 μm). The Landsat images used in this paper were taken in the 0.6 - 0.7 μm band which offers the best contrast for ice and snow observations. However, figure 15 was taken in the 0.7-0.8 μm band, since the other bands were not available for processing on the day this image was taken.

The Winter of 1977

The Chesapeake Bay area experienced harsh weather during the fall and winter of 1976-77 (table 7). October, November, and December were very cold and in January many locations were 10-12°F (4-5°C) colder than normal. Wilmington, Del., and Norfolk, Va., located at the opposite ends of the bay, recorded their coldest January ever. Baltimore, Md., was 10.5°F (4.3°C) below normal for the month, and not since 1881 had the January maximum temperature failed to reach 50°F (10°C). Due to the persisting cold, snow remained on the ground for as long as 40 days in many locations, from early January through the first week of February. In response to the cold weather, water temperatures during the fall were well below normal (table 8) and freezing occurred rapidly when blasts of Arctic air penetrated the area in early January. In mid-February temperatures began to moderate and by March, with the arrival of unusually warm air, the severe winter came to an end.

In most winters ice in the Chesapeake Bay is confined to the upper bay and its tributaries,

Table 7.--Average monthly air temperatures (°F) and departures from normal at Baltimore

Fall-Winter	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Ave.
Normal temp.	57.1	46.0	36.3	33.4	35.4	43.1	41.9
1976-77	-4.5	-5.2	-3.7	-10.5	+1.7	+7.2	-2.5
1977-78	-1.4	+3.1	+0.3	-4.2	-7.5	-1.1	-1.8
1978-79	-1.3	+2.1	+4.9	-0.3	-9.2	+5.7	+0.4
1979-80	-1.7	+4.5	+5.0	+0.4	-3.3	-1.3	+0.6
1980-81	-2.1	-1.9	+0.2	-5.5	+4.0	-0.9	-1.0

Normals based on 1941-70 data

Table 8.--Average monthly water temperatures (°F) and departures from normal near Baltimore

Fall-Winter	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Ave.
Normal temp.	64.6	54.2	43.1	37.6	37.2	43.0	46.6
1976-77	-2.1	-6.2	-4.6	-6.0	-4.1	+1.8	-3.5
1977-78	-3.0	+0.1	-2.4	-2.1	-3.2	-1.7	-2.1
1978-79	-2.0	+1.2	+2.7	-1.1	-4.0	+1.2	-0.3
1979-80	-1.6	+0.9	+2.9	+2.6	+0.2	-0.7	+0.7
1980-81	-0.6	-3.2	-2.6	-3.5	+2.3	-0.9	-1.4

From Coast and Geodetic Survey records--temperature measured 1 ft (0.3 m) beneath water surface. Data collected since 1914.

Table 9.--Maximum ice cover extent in the Chesapeake Bay

	1977	1978	1979	1980	1981
Estimated percent	85	30	60	15	50
Estimated date	Feb. 10	Feb. 17	Feb. 20	Mar. 2	Jan. 18

Ice cover extent estimated from Landsat imagery and Coast Guard reports.

Table 10.--Average monthly air temperatures (°F) and departures from normal at Baltimore for years having severe ice conditions

Fall-Winter	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Ave.
Normal temp.	57.1	46.0	36.3	33.4	35.4	43.1	41.9
1903-04	+1.3	-2.8	-3.3	-6.0	-6.8	+1.5	-2.7
1917-18	-4.5	-1.4	-7.9	-9.2	0.0	+4.1	-3.2
1935-36	+1.4	+4.4	-3.5	-2.6	-5.7	+5.7	-0.1
1960-61	-0.5	+0.9	-7.9	-5.8	+1.6	+1.9	-1.6
1962-63	+0.6	-4.5	-5.4	-4.6	-7.6	+1.8	-3.2
1976-77	-4.5	-5.2	-3.7	-10.5	+1.7	+7.2	-2.5

Table 11.--Average monthly water temperatures (°F) and departures from normal near Baltimore for years having severe ice conditions

Fall-Winter	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Ave.
Normal temp.	64.6	54.2	43.1	37.6	37.2	43.0	46.6
1903-04	No records available						
1917-18	-4.9	-5.5	-5.9	-5.8	-3.8	-0.6	-4.4
1935-36	-0.7	+2.3	-2.1	-3.3	-4.7	-0.2	-1.5
1960-61	+2.2	+0.2	-1.4	-2.8	-1.0	+1.8	-0.5
1962-63	+1.5	-2.6	-1.6	-3.4	-4.1	-0.8	-1.8
1976-77	-2.1	-6.2	-4.6	-6.0	-4.1	+1.8	-3.5

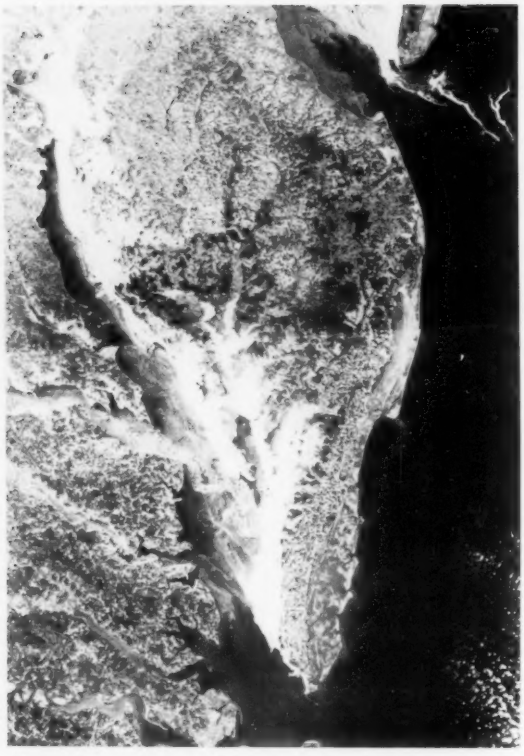


Figure 12.--Mosaic of Two Landsat Images Taken on February 7, 1977.

but in January and February of 1977 the ice cover was extensive in the lower bay south of the Potomac River, as well as the upper bay. Ice began to form in the tributaries of the upper bay during the last few days of December, 1976, and by the middle of January the ice had expanded well into the southern part of the upper bay.

The maximum ice cover extent was reached in early February. Figure 12 is a Landsat image taken on February 7, 1977. The ice cover as observed on this image is concentrated in the eastern part of the bay. The region had been subjected to strong northwest and westerly winds for several days at the end of January and the beginning of February, which forced the ice against the eastern shores of both the Chesapeake and Delaware Bays. However, subsiding winds permitted the ice to reform along the western shores of both bays. The ice cover in the central Chesapeake Bay shows definite patterns of longitudinal cracking and compression fracturing which is largely a result of the constant winds.

In addition, note the extension of ice off the tip of Cape May, New Jersey, which has been driven into the open Atlantic by the force of the wind. Currents from rivers entering the bay and tides also affect the formation, movement, and break-up of the ice. Although tidal currents are relatively weak throughout the bay (less than 2 kn [1 m/sec]), some ice floes may be transported by this mode.

Approximately 85 percent of the Chesapeake Bay was ice covered as measured from Landsat on the February 7 image (table 9). In a normal year only about 10 percent of the bay is covered with ice. The ice cover during the winter of 1977 rivals that of 1918, which was probably the most severe this century.

Because the ice conditions were so severe during the winter of 1977, Coast Guard cutters were kept very active keeping shipping lanes open, freeing vessels that became locked in the ice, and leading convoys into the ice choked harbors and tributaries of the bay. Ship passage and navigation were very hazardous in the entire bay from the middle of January through the middle of February, and ships were required to have steel hulls with a minimum of 1,000 horsepower. Many tributaries were impassable. The Coast Guard cutter, CHINOOK, was called upon to make 87 assists during this period.

The ice and freezing waters also took their toll on fish and marine life, particularly shellfish, such as crabs and oysters. Marine life in the upper bay and its tributaries suffered the greatest damage. In some areas the mortality rate of large crabs was as high as 77 percent. Furthermore, piers, marinas, light houses, and other such structures received considerable damage from the crushing ice pressure produced by ice floes shifting on the ebb and flood tides.

The Coast Guard, the Maryland Department of Natural Resources (which was also involved in icebreaking activities) routinely took ice thickness measurements at various locations in the bay. In early February, at the time of the greatest ice cover extent, the thickest ice was reported in the tributaries and estuaries of the upper bay where thicknesses of between 10 and 24 in (25 and 61 cm) were not uncommon. Ice thicknesses in the tributaries of the lower bay ranged from about 4-14 in (10-36 cm). The ice in the upper bay was generally about 6-12 in (15-30 cm) thick, and in the lower bay the ice was about 2-8 in (5-20 cm) thick.

The Winter of 1978

Cold air pierced the bay area in early January of 1978 and remained with virtually no thaws until early March (table 7). At Baltimore, the daytime maximum temperature never exceeded 50°F (10°C) from January 1 until February 25. Although the cold air was persistent, it was not extreme. Because of the enduring cold, snow remained on the ground for nearly 60 consecutive days in most rural areas. This was one of the longest periods of continuous snowcover in the Chesapeake Bay area this century.

Some ice began to form in the tributaries of the upper bay during the middle of January, and by the end of the month, ice could be detected in the northern end of the upper bay. By February 15, 1978 (fig.13) it can be seen that ice has formed well into the southern part of the upper bay. The Coast Guard report on February 14, 1978, indicated that only minor unconsolidated ice floes were observed in the lower bay. In the upper bay, although the ice cover was not as continuous as in 1977, the ice was extensive and

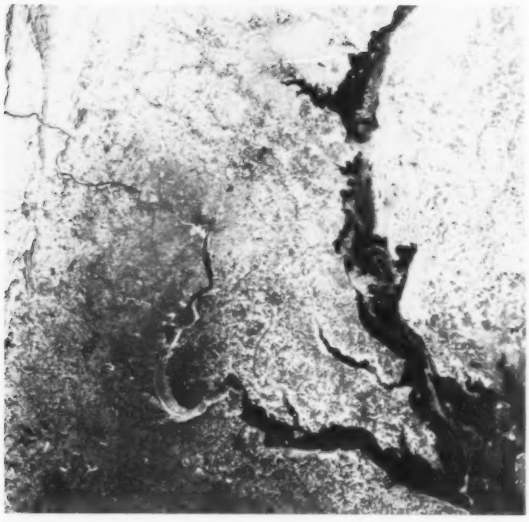


Figure 13.--Landsat Image Taken on February 5, 1978.

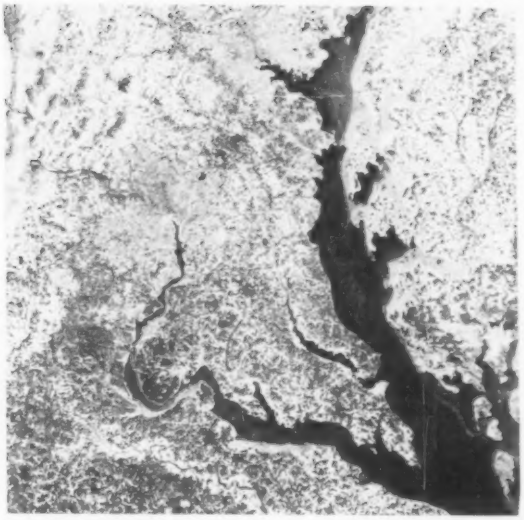


Figure 14.--Landsat Image Taken on February 10, 1979.

had become evident in nearly all of the tributaries, estuaries, and inlets. As was the case in 1977, prevailing west and northwesterly winds dislodged the ice from the western shore of the bay; however, the ice was not compacted against the eastern shore as it was the previous year. The maximum ice cover extent in 1978 was reached in mid-February. This is about one week later than the maximum cover occurred the year before. Approximately 30 percent of the bay was covered with ice on February 15 as measured from Landsat imagery.

Navigation was somewhat impeded by the ice cover in 1978 but never brought to a standstill as in 1977. The Coast Guard report on February 15, 1978, stated that shipping channels in the Chesapeake Bay and Potomac River had limited ice and were easy to moderately easy to transit. There were no horsepower limitations in effect in 1978, and commercial fishing boats and oyster tongers did not lose any working days because of the ice. Furthermore, the ice and freezing waters did not have the same devastating effect on fish and other other marine life as the year before. Only relatively minor damage occurred to marine life during the winter of 1978.

The Winter of 1979

Temperatures in the Chesapeake Bay area were above normal during the fall of 1978 (table 7) and near normal for January 1979. But February 1979 was the coldest and snowiest February this century in the Chesapeake Bay area. The average temperature at Baltimore was 25.6°F (-3.5°C), which is 9.2°F (5.1°C) below normal. During the first 3 wk of the month maximum temperatures reached 40°F (4.4°C) on only two occasions, and minimum temperatures plummeted below 0°F (-17.6°C) on as many as 7 occasions in some places in the Chesapeake Bay area. In addition, it was the snowiest February since 1899, with Baltimore receiving 33 in (84 cm) of snow. Owing to the record cold and heavy snowfall, snow remained continuously on the ground for about 30 days, from the end of January through the end of February. This was the third consecutive winter that a snowcover persisted for more than 30 consecutive days in the Chesapeake Bay area.

In early February, the ice-covered area increased dramatically as extremely cold air settled over the Chesapeake Bay region. Figure 14, which was taken on February 10, 1979, shows that most of the upper bay north of the Chesapeake Bay Bridge is clogged with ice, and new ice is forming throughout the upper bay to the south of the bridge. This image demonstrates how the bridge acts as a dam by preventing the passage of the large ice floes. All but the largest estuaries entering the bay are jammed with ice. The ice cover reached its maximum extent on about February 20 as the record breaking cold persisted. At this time, approximately 60 percent of the Chesapeake Bay was covered by ice. The Coast Guard reported that navigation was nearly as difficult in February 1979 as in January and February of 1977. However, navigation was seriously hampered for only about 2 wk in 1979 compared with about 5 wk in 1977. In February 1979 the large volume of snow on the ice hindered icebreaking activities and the icing conditions were such that the imposition of certain shipping restrictions was necessitated. For example, north of the Chesapeake Bay Bridge all shipping traffic was required to be part of Coast Guard convoys regardless of the cargo, and all ships were required to have steel hulls and a minimum of 1,000 horsepower. Because the ice and freezing waters did not persist as long in 1979 as in 1977 the damage to fish and other marine life was not as severe.

The Winter of 1980

The winter of 1980 began warm but ended cold. December (1979) was the warmest December since

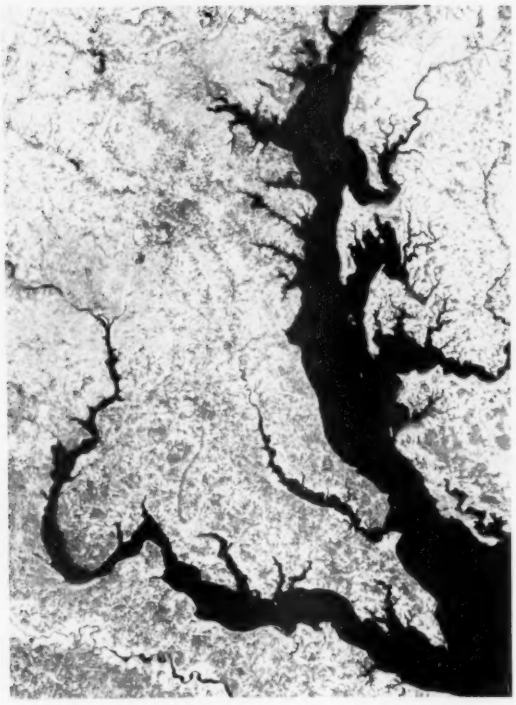


Figure 15.--Landsat Image Taken on March 3, 1980.

1971, however, for the third consecutive year. February temperatures were well below normal (table 7). The coldest air of the winter affected the Chesapeake Bay area in late February and early March.

Ice began to form in the estuaries and tributaries of the upper bay during the first part of February. By early March (fig. 15) ice was evident in the upper bay as far south as Baltimore. At this time approximately 15 percent of the bay was ice covered. Coast Guard reports indicated that the ice cover did not delay shipping traffic. Also marine life and shellfish showed no adverse effects as a result of the winter weather of 1980.

The Winter of 1981

From table 1 it can be seen that the average air temperature for December (1980) was very close to the 30 yr mean. However, the second half of December was about 8°F (4.5°C) colder than the first half of the month. From mid-December through mid-January extremely cold weather prevailed throughout the Chesapeake Bay area, and many locations dropped below 0°F (-17.6°C) on several different nights during this period. Actually the winter of 1981 was somewhat similar to the winter of 1977 (tables 7and 8) in that for both years the autumn temperatures were below normal, January was very cold, and February was warm.

In late December, ice began to form in the upper reaches of the Chesapeake Bay, and by mid-January (fig. 16) much of the upper bay (north

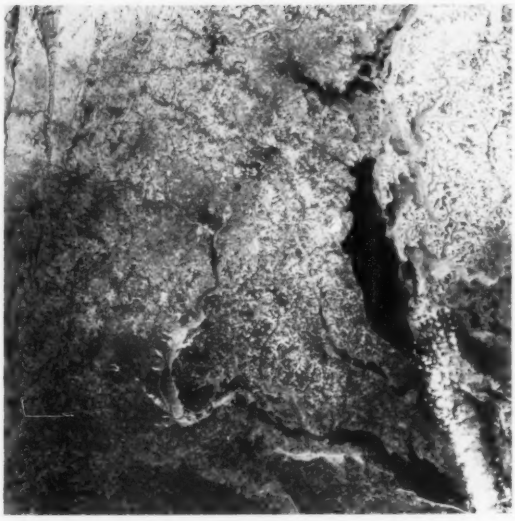


Figure 16.--Landsat Image Taken on January 12, 1981.

of the Potomac River) was ice covered. The Potomac River was jammed with ice for most of its course, as were most all of the tributaries entering the upper and lower bay. A band of clouds conceals newly forming ice, as seen in the lower right of the January 12 image. It is estimated that at the time of the maximum ice cover extent (about January 18) approximately 50 percent of the Chesapeake Bay was ice covered. In 1981, the ice formed earlier and melted faster than in the other 4 yr (1977-80). As can be seen in table 9, the maximum ice cover extent occurred progressively later each winter until the winter of 1981.

The Coast Guard reported that north of the Chesapeake Bay Bridge, during early January, all shipping traffic was required to be part of Coast Guard convoys due to the extensive ice cover. Also, north of the Choptank River, ships were required to have steel hulls with a minimum of 1,000 horsepower. Ice conditions in the bay and the problems the ice presented to navigation were similar in 1981 to 1979, and as was the case in 1979 damage to fish and other marine life was not as harmful as in the winter of 1977.

Severe Ice Conditions on the Chesapeake Bay

Since the average air temperature for January and February, which are the two coldest months in the Chesapeake Bay area, is about 32°F (0°C), it is evident that for ice conditions to become severe, temperatures that are much below normal must be experienced for an extended period of time. Tables 10 and 11 present departures from normal for average monthly air temperatures and water temperatures, respectively for those years having severe ice conditions. During these years the upper bay and its tributaries were nearly totally ice covered and navigation was brought to a halt. For the 2 yr that ice conditions were most severe in the Chesapeake Bay (1918 and 1977), it can be seen from tables 10 and

11 thatthe air temperatures were below normal for each month from October through January and averaged 5.8°F (3.2°C) below normal for the 4 mo period in 1917-18 and 5.9°F (3.3°C) below normal for the 4 mo period in 1976-77. The water temperatures for each month from October through February were also below normal for each of these 2 yr. Because of the lengthy period of unusually cold weather, the entire bay was nearly completely ice covered in late January and early February in each of these 2 winters. Additional winters in which ice was noteworthy on the Chesapeake Bay during this century include 1917, 1920, 1923, 1934, 1940, and 1959 and also 1968, 1970, 1978, 1979, and 1981. During these years the ice was generally confined to the upper bay and its tributaries, but the upper bay was not completely iced over and navigation was impeded but not halted.

Knowledge of early weather records and ice conditions in the Chesapeake Bay area during the 17th, 18th, and 19th centuries is inadequate. There were few continuous meteorological observations over substantial periods, and no voluminous personal diaries exist that shed light on the weather and climate of these times. Only certain outstanding events with a minimum of detail have been recorded and documented. However, from the sketchy evidence that is available, it can be surmised that severe ice conditions probably existed on the Chesapeake Bay during the winters of 1642, 1646, 1681, 1698, 1705, 1733, 1741, 1765, 1780, 1784, 1807, 1821, 1836, 1856, and 1893. Of these years it is likely that the most severe freezes occurred on the Chesapeake Bay during 1698, and during the Revolutionary War in 1780 and again in 1784. It is reported that Baltimore Harbor remained closed to shipping traffic from January 2 until March 25 in 1784.

References may be obtained by contacting the author.

SAILING TRANSATLANTIC

Mariners Weather Log

J. N. Newman
Department of Ocean Engineering
Massachusetts Institute of Technology
Cambridge, Massachusetts

Numerous yachts sail across the North Atlantic each summer. Our own passage may be unique only insofar as three of the five persons aboard were trained as naval architects or marine engineers. My specialty is ship hydrodynamics, a subject where the North Atlantic can provide endless lessons.

The plan was to depart Woods Hole in June 1981, stop in St. John's, Newfoundland to change crew, and then cross to Barra Head, Scotland. This would leave time for cruising in the Hebrides, Orkneys, and Shetland Islands before crossing the North Sea and proceeding up the Norwegian coast to Trondheim.

The KATRINA (fig.17) is the product of a backyard building project which began in 1969, based on the fibreglass hull and deck moldings for a stock Morgan 38. She had been built for coastwise family cruising, and occasional races, but in the subsequent 11 yr equipment was added and sailing horizons gradually widened. Most importantly, from the standpoint of reliability and confidence in our vessel, we had logged over 15,000 mi without any significant failures or breakdowns.

Figure 17.-- The KATRINA sailing in the Gulf of Maine, July 1979. Photo by C.J. Beringer.

Our sail inventory for the crossing included two spinnakers, four jibs ranging in size from the "heavy number one" genoa down to a tiny storm jib, a heavy staysail with a roller-furling arrangement, two mainsails, and a storm trysail.

In calm periods we could rely on the faithful but noisy engine, with a range of 500 mi under power, and the means for charging three storage batteries to power the lights and electronic instruments. The latter consist of a knotmeter/log, wind direction and velocity indicators, a depthsounder, VHF and single-sideband transceivers, Loran-C receiver, radio-direction finder, and a small autopilot. The list of safety equipment included an inflatable liferaft, two EPIRB emergency beacons, and survival suits for the entire crew.

My sight reductions are performed with a programmable hand calculator equipped with a plug-in navigation module which includes a perpetual almanac. The same calculator is used with another program to convert Loran readings to latitude and longitude, and to compute great-circle courses. A second calculator is carried as a spare, together with conventional almanacs and sight-reduction tables in the event that both calculators fail.

Ten days were spent on the first leg from Woods

Figure 18.-- The five crewmembers of the KATRINA.

Hole to St. John's, with stops at Halifax, Louisburg, and St. Pierre. Thanks to a weak cold front which passed through on July 2, we enjoyed spectacular visibility rounding Cape Race and along the east coast of Newfoundland. July 3 was spent in St. John's, changing crew and taking on stores. With the clear weather and a fresh westerly wind we were eager to depart as soon as possible.

Our crew (fig.18) for the crossing, in addition to my wife Kathy and myself, included Jens Kaalstad, a student in the Shipbuilding Department at Trondheim, Raphael Vermeir who works in the marine department of Conoco in Houston, and John McLean, a mechanical engineer from Falmouth, Mass.

From St. John's the great-circle distance to Barra Head, Scotland, is 1,736 mi. Our intention was to head due east to 35°W longitude, about midway on the crossing, and then northeast to Barra Head. This diversion south of the direct route increases the distance by about 150 mi, but avoids the area southeast of Iceland, where maximum wave heights are shown on the Pilot Chart. It also would give us some warmth and fair current along the north edge of the Gulf Stream, while staying clear to the north of the principal shipping lanes.

July 4 dawned bright and clear, with a continuation of the fair westerly wind. Last-minute errands included a visit to the Ministry of Transport to check on ice reports and to file a float plan. We departed at 1100, under reefed main and number 2 genoa, and enjoyed a fast broad reach until the wind dropped after midnight.

A northeasterly breeze filled in on July 5, and gradually backed to give another fast reach. On this occasion and subsequently, when a moderate wind developed from calm conditions, I was surprised to observe the nonlinear wave-to-wave interactions which transfer energy from short to long wavelengths. These were most apparent from the initial development of short steep waves, 2

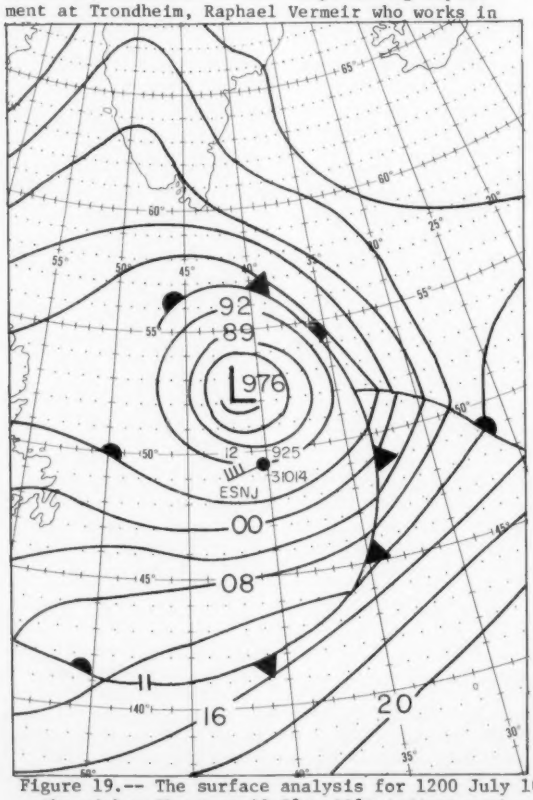


Figure 19.-- The surface analysis for 1200 July 10, on the left and the satellite image for 1129 on the right. The + at 48.5°N, 32°W indicates the position of the KATRINA in relation to the storm.

to 3 ft high and 30 to 60 ft long, which subsequently smoothed out into longer waves with practically no change in height.

The northerly wind gradually diminished between the Grand Banks and the Flemish Cap. This wind was associated with a low centered about 500 mi northeast of our position, and moderate seas were experienced from the north-northwest. The Labrador Current gave us a southerly set of about 1 kn throughout July 6.

The storm was described in the "Monster of the Month" in the September-October 1981 issue of the Mariners Weather Log. Figure 19 shows the surface analysis at 1200 on the 10th and the satellite image at 1129. Our position at 1200 was 48°30'N, 32°W, 435 mi southeast of the center.

A southerly wind filled in during the third night, giving welcome relief from the engine. Several fishing vessels were sighted during the night, one sufficiently close to require a change of course. By 0530 on July 7 the wind had increased sufficiently to call for a reef in the mainsail, and shortly afterwards the small genoa was replaced by the staysail. The wind continued to build from the south, during the morning watch, and with gusts in the 30-40 kn range a double reef was required.

Comparisons of the Loran fixes with the log indicated an easterly current of about 1 kn, and there was a noticeable rise in temperature. We had converged with the Gulf Stream.

The synopsis from NMN Portsmouth, VA, warned of a developing gale center off the Labrador coast, and a second LOW moving up the coast was forecast to merge with the gale.

By noon of July 8 we were at 47°48'N, 38°50'W, practically a third of the way across. With the wind up to 40 kn, all hands were called at 1245 to set the trysail. In spite of a building sea, with wave heights of 10 to 12 ft, conditions were not unpleasant and good progress was maintained. By evening the wind had moderated and the jib was reset.

The morning forecast from NMN on July 9 predicted little movement of the Labrador gale, and its merger with the LOW centered over Newfoundland. The magnitude of this storm was measured in terms of its deepening barometric pressure, and more vividly for us by its radius of influence in the southeast sector, where we were situated 600 mi from the center.

Thanks to the gale we had enjoyed a run of 140 mi on the log and 145 from the Loran in a 23 hr day which resulted from advancing the ship's clock by 1 hr. Afternoon sun sights put us on a line within 2 mi of the Loran, and just east of 35°W.

Evening brought a return of the wind to 30 kn, and an ominous forecast from NMN. A third LOW was merging with the gale, and winds up to 45 kn were forecast for the southeast sector out to a radius of 650 mi. An easterly track was predicted for the next 2 days and, just to add a little spice, two sloops were reported overdue between Bermuda and the United States. Over dinner we discussed the conflict between the approaching storm to the north, and the steamer tracks to the south. It seemed prudent to divert our course to avoid the storm, but the visibility was reduced to a few hundred yards by the patchy fog, and we had no desire at this stage to meet a ship. Faced with this dilemma we vacillated between a heading of east-southeast for Portugal, or due east towards Brittany.

Another concern at this stage was the absence of weather forecasts for the remaining portion of the crossing. Coming from North America it seemed hard to believe that no voice broadcasts are available from European high-frequency stations, and I called Portishead to verify that they did not provide this service. If nothing else was accomplished, this at least confirmed our ability to communicate from mid-Atlantic.

With the anemometer reading 30 to 40 kn and gusting to 50, the storm trysail was reset at the 2200 watch change. By dawn of July 10 the wind had dropped somewhat, but the NMN synopsis upgraded the gale to an intense storm with a pressure of 980 mb.

The 1130 broadcast from NMN brought welcome news. The storm was turning northwestward, and by noon ship's time (1300 GMT) we experienced clearing and more moderate conditions. With a sense of relief the course was altered to due east magnetic or 070° true, heading for Scotland at last. The sun appeared in the afternoon, for the first time in 4 days, but the attempts to get a sight were frustrated by our motions and waves obstructing the horizon.

During July 11 to 12 we enjoyed fast sailing in west or northwesterly winds of 15 to 25 kn, running in the swell left over from the storm. Practically all the significant waves appeared to be remarkably uniform, between 6 and 10 ft high, and 200 to 300 ft long. Occasionally two crests would coincide to give a local doubling of the wave height up to about 20 ft (fig.20). This phenomenon seemed obvious, but in contrast with the usual assumption of a continuous (e.g. Rayleigh) distribution of wave height. The difference may be due to the fact that the observer's eye focuses upon the local peak of a wave, whereas a conventional wave recording device gathers its data without such a bias.

Light to moderate westerly winds prevailed on July 13-15. In the evening of the 14th we were pleased to receive our first European weather broadcast, from the Oban, Scotland marine operator on two MHz. Their report was very welcome, and gave us a useful synopsis 500 mi out, but Oban and possibly other British MF stations are currently being phased out in favor of VHF.

The evening forecast from Oban on July 15 predicted a wind shift to the northwest, and this came abruptly at 2245, along with a tanker which passed about 2 mi to starboard, heading into the Irish Sea. Dawn of the 16th brought more wind, and sail was reduced to the staysail and reefed main. With the wind abeam we had no difficulty maintaining our speed and at noon had completed our best 24 hour run, 161 mi. By evening the northwesterly wind had increased to 30 kn, and a second reef was needed. The seas were building to 12-15 ft, and our last night at sea was cold,

Figure 20.-- The crest of a 20-ft wave on the afternoon of July 10 near 49°N, 31°W. The shoulder and neck of a crewmember leaning over shows in the lower right foreground. Photo by J.N. Newman.

with occasional rain squalls. A magnificent rainbow was observed in the evening, with a partial image close alongside.

Approaching the coast the notch filters of the Loran required a fine touch to avoid interference from the Decca system. After 12 days at sea it was hard to convince myself that we were about to make landfall at the expected spot.

Some assurance came when an outbound freighter emerged from the mist ahead, and made a gradual turn to the north around our stern, following a logical course if the Hebrides were to port. My confidence soared when a couple of return signals were observed on the depthsounder, precisely where the chart showed soundings within our range of 60 fathoms. After that confirmation it was anticlimactic when Bernay Island emerged from the mist on the port bow at 1100, exactly 13 days from our departure.

WE OF NOAA ARE MAKING USE OF THIS SMALL AMOUNT OF SPACE TO EXTEND OUR THANKS TO ALL THE SHIPS' OFFICERS WHO ROUTINELY TAKE SHIPBOARD WEATHER OBSERVATIONS. TO US, THESE EXCELLENT OBSERVATIONS ARE PRICELESS. WE CERTAINLY DO APPRECIATE RECEIVING THEM REGULARLY.

Hints to the Observer

HURRICANE REPORTING LETTER

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL WEATHER SERVICE
Silver Spring, Md. 20910

OA/W521x2/JWN

June 1,1982

Dear Captain:

Because of the number of tropical storms and hurricanes between June 1 and November 30 the period has been designated as the hurricane season. Many special programs in response to this threat are started on June 1 including this alert letter to ships that we service. We also request a change in your observation schedule when in the vicinity of a tropical storm or hurricane as follows:

1. When within 300 miles of a tropical storm or hurricane, transmit weather observations at least every 3 hours.

2. In the "Remarks" section of the Ship's Weather Observations NOAA Form 72-1 (also called the log or record) and in the weather message transmitted by radio, include the lowest pressure and/or the highest wind encountered since the last synoptic (0000, 0600, 1200, or 1800 GMT) report, if:

   a. The pressure was more than 5 millibars lower and/or,

   b. The wind was more than 15 knots higher than the last report. Include the time of occurrence in the radio message and on the record.

3. Use the prefix "STORM" on the weather message. If you are in a named tropical storm or hurricane use the name in the remarks. Example radio message:

   STORM (standard weather report) HILDA 0915Z LOWEST PRES 982MB 0918Z HIGHEST WIND 75 KTS GUSTS TO 100 KTS.

On behalf of your fellow mariners who will benefit from your observations and the National Weather Service, I express our appreciation for your weather observations. I wish you a safe hurricane season.

Sincerely yours,

R. E. Hallgren

Richard E. Hallgren
Director, National Weather Service

Tips to the Radio Officer

Larry Murphy
National Weather Service, NOAA
Silver Spring, Md.

CORRECTIONS TO WORLDWIDE MARINE WEATHER BROADCASTS (June 1981 EDITION)

Page 7

1-0010 Norfolk, Va., U.S.A. NAM
Area:
(A) North Atlantic, west of 35°W, including Caribbean Sea and Gulf of Mexico.
(B) North Atlantic, east of 35°W, and Mediterranean Sea.

0030, 1230	8090 12135 16180 20225[1]	F,W,A,IB[2]
0500, 1700	do.	IB[2]
0630, 1900	do.	W,F[2]
1000, 2300	do.	F,W,A[3]
1000, 2300	do.	IB

1 1200-0000 only
2 For area A
3 For area B

1-0020 Halifax, N.S. Canada CFH[1]
Area: North Atlantic

0130, 1330	438 4255 6430 8697 12726 16926.5	W,F

1 Naval broadcast, schedules may change without prior notice.
2 Off air 1300-1700 second Thur. each month.

Page 8

1-0215 Key West, Fla., U.S.A. NAR
Area:
(A) North Atlantic west of 35°W, including Caribbean Sea and Gulf of Mexico
(B) Atlantic east of 35°W and Mediterranean Sea

0030, 1230	5870 25590	W,A[1]
0630, 1900	do.	W,F[1]
0500, 1700	do.	IB[1]
1000, 2300	do.	W,A,[2]

1 For area A
2 For Area B

Page 10

1-0385 Thurso, Scotland GXH
Area: Same as NAM 1-0010

0030, 1230	3724[1]	W,A[3]
0500, 1700	do.	IB[3]
0630, 1900	7504.5	W,F[3]
1000, 2300	12691<2>	W,F,IB[4]

1 1900-0800 only
2 0800-1900 only
3 For area A
4 For area B

Page 11

1-0475 Reykjavik, Iceland NRK
Area: Same as NAM 1-0010

0030	5167	W,A[1]
0630, 1900	do.	W,F[1]
0500	do.	I[1]
1000, 2300	do.	W,F[2]

1 For area A
2 For area B

Page 12

1-0565 Rota, Spain AOK
Area: Same as NAM 1-0010

0030, 1230	5917.5 7705	W,A[1]
0630, 1900	do.	W,F[1]
0500, 1700	do.	I[1]
1000, 2300	do.	W,F[2]

1 For area A
2 For area B

Page 13

1-0610 Rome, Italy IAR
Change area to read: Mediterranean Sea

1-0635 Athens, Greece NGR
Area: Same as NAM 1-0010

0030, 1230	4623 13372.5	W,A[1]
0630	do.	W,F[1]
0500, 1700	do.	I[1]
1000, 2300	do.	W,F[2]

1 For area A
2 For area B

Page 17

1-0880 Vancouver, B.C., Canada VAI
Change times 0130 to 0200, 0530 to 0600, and 1730 to 1800.

Page 18

1-0930 Honolulu, Hawaii NMO
Delete frequency 4525.

1-0920 Astoria, Ore. NMW[1]
Area: (See figure 12.)
Waters up to 300 NM offshore from Cape Flattery to Pt. St. George.

0400, 1830	472	S,F,LR

1 Remotely keyed by NMC

Page 20

1-1190 Shanghai, Peoples' Republic of China XSC
Change frequency 16938 to 17002.4.

Page 40

2-0630 Reykjavik, Iceland TFA
Delete last two lines of schedule and add new line as follows:

On request:	1876(A3)	F[2]

Page 47
Delete frequency 1630 from the following stations:

2-1300	Prince Rupert
2-1310	Sandspit
2-1320	Bull Harbor
2-1330	Alert Bay
2-1350	Tofino
2-1360	Comox
2-1370	Vancouver.

Page 48
2-1380 Victoria, B.C., Canada VAK
Delete frequency 1630 and add (A3H) to frequency 2054.

2-1420 Astoria, Ore., U.S.A. NMW
Area: (See figure 12.)
Waters up to 300 NM offshore from Cape Flattery to Pt. St. George
0533, 1733 2670(A3J) S,F,LR
157.1MHz

Page 55
3-0050 Norfolk, Va., U.S.A. NAM
Add time 1200 on first line of schedule.

Page 57
3-0135 Offenbach/Main Mainflingen, Federal Republic of Germany
Area: Northeastern North Atlantic; Mediterranean Sea
Frequency (kHz):
134.2

0359, 0459	Surface analysis
0945, 1148	
1553, 1659, 2200	
0530, 1053, 1741, 2252	24-hr surface prognosis
1102	48-hr surface prognosis

Page 64
3-0385 Bejing (Peking) Peoples Republic of China BAF
Area: Western Pacific, East China Sea
Frequency (kHz):
5525, 8120, 10115, 14365, 18235

0520	72-hr Sfc prognosis
0540	Surface analysis
0440	48-hr Sfc prognosis
1043	Tropical analysis
1103, 2320	Typhoon tracks

Page 74
4-0185 Durban, South Africa ZSD
Area: Durban East, Aqulhas to Maputo, Mozambique Channel
Frequency (kHz): 8706, 13073
1715 Forecast and Warnings
Frequency (kHz): 13073, 17200
0915 Forecast and Warnings

Page 88
Figure 4--Extend the southern boundary of the area called EAST SOUTHERN SECTION eastward to the coastline and then northward to the coastline of Spain and name the new area formed TRAFALGAR. It should be to the east of EAST SOUTHERN SECTION and south of FINISTERRE.

ACKNOWLEDGMENTS

Our thanks go to Harry O'Brien, Radio Officer on the SS MARGARET LYKES for his information on IAR broadcasts and on the omission of the area TRAFALGAR on Figure 4.

NOTE

See Note to the Radioman in MARINE OBSERVATION PROGRAM.

Marine Observations Program

J.W. Nickerson
National Weather Service, NOAA
Silver Spring, MD 20910

The Port Meteorological Officers (PMO's) have forwarded letters that they received about the new Observing Handbook and observation forms being delivered late. The PMO's are in no way responsible for the late arrival of your material. After reviewing the previous handbook we decided to completely rewrite it. We were late because it was a vast project and we only had half-vast resources to commit to it.

NWS OBSERVING HANDBOOK NO. 1

Since the handbook is a departure from the more stylized government format, we need to know if this handbook satisfies your needs as an observer.

The following questions are intended as a base, please comment and expand as appropriate.

1. Are the looseleaf binders more useful to you than standard bindings?
2. Is the writing and style clear?
3. Chapter 1 contains more information about how the National Wather Service uses your ship's weather observations. Was this helpful? Did it answer all your questions?
4. We have initiated the SPREP (special report) for ships, so that you may report weather conditions that are noteworthy or haven't been forecast (page 1-9). Do you think this will help improve forecasts?
5. In Chapter 2, we have the sections and groups of the weather code flagged by page separators and have brought the tables into the code sections. Do you find this convenient?
6. In the wind group, Nddff, we proposed using surface roughness, "look of the sea," or "seaman's eye" in estimating the wind. If your ship doesn't have an anemometer, how do you estimate the wind speed?

7. Were you aware that you do not have to twirl the sling psychrometer with an apparent wind of 9 kn or more (page 2-58)?

8. Were you aware that you do not need a barograph to report pressure tendency 5appp (page 2-76)?

9. Present and past weather, and several other tables have been rearranged in priority order, i.e., the first weather that you observe, reading from the top of the table is also the highest priority. Does this make it easier for you?

Please add any comment, questions or requirements that will help us assess this handbook and prepare updates and additions. At sometime in the future we felt it would be useful to add explanatory chapters on the various subjects such as weather, instrument exposure, waves, weather avoidance, etc. If you feel these would be useful, please add the subjects you feel should be discussed to your other comments.

SHIP'S WEATHER OBSERVATIONS, NOAA FORM 72-1A

With the new synoptic code we have also developed a new record form, the 72-1A. Although the front page is new, and we would like comments, it is the back where the big changes are.

With the previous system, when an observer had a comment or complaint about a forecast, he would wait until he got back to port to make a complaint. All too often the complaint would never be made, no correction would be made and the same problem would be repeated. With the new form you may make your comment or complaint when the situation for it is occurring in the "Weather Forecast Evaluation" section. There are also sections of freak waves and communications problems.

When you make up a package of 72-1A's to send to your servicing PMO, please fill out the ship's name, address, etc. on the top form and check the appropriate comments summary box. The PMO will make copies of your comments and ensure that they are properly distributed for corrective action.

SEA WATER TEMPERATURE DIP

I prefer the term "dip" rather than "bucket" because dip more correctly describes what we are doing and if someone actually used a full-sized bucket they could be seriously injured. However, dip and bucket are used interchangeably to identify the procedure for measuring sea-surface temperature throughout the literature.

As described in the NWSOH No. 1 (page 2-116), the sea-surface temperature (SST) can actually vary several degrees Celsius between day and night measurements. The change, of course, is affected by cloudy skies and wave mixing of the surface layer. It is still important to measure actual sea temperature as close as possible to the surface because it is only at this air/sea interface that the sea cools or warms the air and supplies moisture to it.

Most ships measure sea-water temperature by calling the engine room for induction manifold temperature. There are several problems with these measurements: They are made from water that is taken into the ship from depths as much as 90 ft below the surface. The water has traveled along the hull of the ship, taking on or giving off heat for as much as 900 ft. Finally, the thermometer is intended to provide the needs of boiler engineering, not provide meteorological measurements. Some boiler room thermometers are divided into increments of 2 degrees and may also be inaccessible for close reading.

The ship SST measurements are used in all kinds of weather and oceanographic analyses and forecasts as well as providing ground truth data for satellites. We need data that is more accurate than we normally get from induction manifold measurements in a deep-draft vessel. We have two approaches to a solution: Record on the 72-1A, but do not transmit SST measured by any method below 10 meters. Use a Sea-Water Temperature Dip.

The Sea-Water Temperature Dip (SWTD) is a thin-cased brass tube with a tested thermometer inside. The bottom of the tube is closed to hold a small amount of water around the bulb of the thermometer. It is made to be lashed and taped to a weighted line (fig. 21), because it is so light.

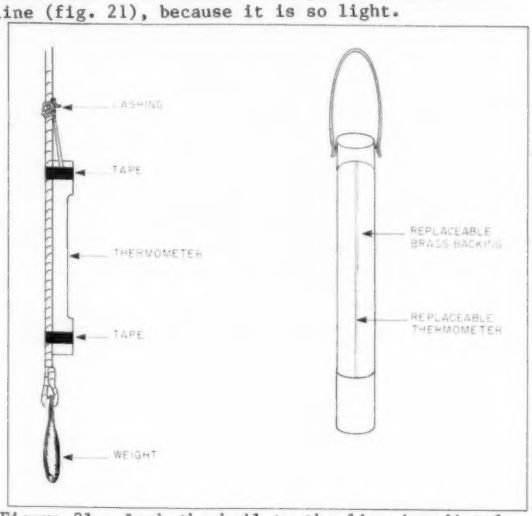


Figure 21.--Lash the bail to the line immediately above the weight. Tape the tube to the line over the bail connection and around the base.

1. After it has been attached to a line, it is lowered close to the water's surface and swung in line with the ship.

2. At the forward end of the swing, release enough line so that the SWTD enters the water as shown in figure 22.

3. Take in line so that the SWTD remains close to the surface as it drifts astern.

4. As it reaches a point under you, draw the SWTD from the water as shown in figure 23. Do not allow it to pass aft of your position. This would increase the drag on you and the SWTD.

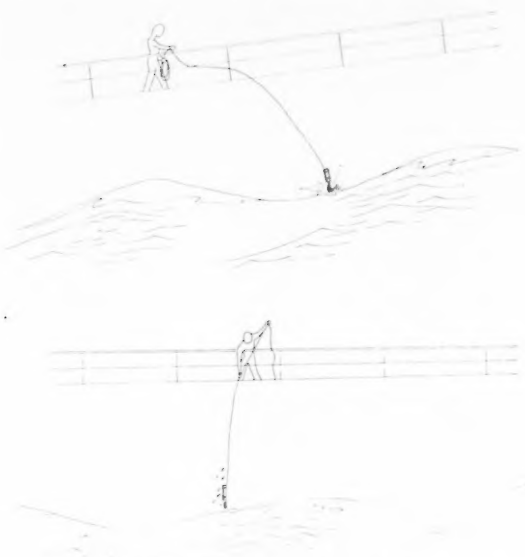
5. Repeat the swing forward and the dip procedures to be sure the temperature of the dip and thermometer are equal to the water temperature.

6. After the second dip, recover the SWTD rapidly and read the thermometer as accurately as possible to the nearest tenth of a degree Celsius.

The SWTD, as all thermometers, should be stored flat or upright, never upside down, to prevent the mercury column from separating.

NOTE FOR THE RADIOMAN

Ship's Weather Messages: To decrease the cost



Figures 22 and 23.--Release enough line on the forward swing so the SWTD enters the water. Retrieve when directly below the observer.

of handling ship's weather messages they will be transmitted in ten-character groups in the future, starting with the position of the ship. The call sign and date/time groups will remain as five-character groups. The prefix STORM or SPREP will also remain as a five-character group.

Example: D....D YYGGi$_w$ 99$L_aL_aL_aQ_cL_oL_oL_oL_o$

$i_{R}i_{x}$hVVNddff $1s_nTTT4PPP$ $7wwW_1W_2$

The "Weather Report for Immediate Transmission," NOAA Form 72-4A, does not have to be changed, nor does the observer need to make any changes in recording the weather message. The radio officer combines the five character groups into ten-character groups ignoring the spaces left by blanks. In the example, the dew point, $2s_nT_dT_dT_d$, and pressure tendency, 5appp, groups are omitted. Any single five-character group at the end of the message remains as a five-character group.

The Editor's Desk

MASSIVE FREAK WAVE

A massive "lump of water" swept three fishermen to their deaths on November 23 despite a last-minute warning from their skipper.

The crew of the stern trawler CLARKWOOD were hauling the net aboard because of gale-force winds when the wave struck.

A fisherman told an inquiry the wave was like a "a big green cliff."

The men who died were the mate, Douglas Walker, 57, crewman Robert Clark, 44, and deckhand George Robertson, 56.

Skipper, Stewart Thomson, 43, told the inquiry: "The ship was struck by a massive lump of water." He saw the sea as it was about to come on board and shouted to the crew as soon as he saw it coming. It lifted up the gear.

He saw three men in the water and tried to maneuver the vessel to pick them up in winds up to Force 9 off Fair Isle.

The crew got a line on to Robert Clark and dragged him on board, but in spite of mouth-to-mouth resuscitation he did not revive.

Crewman, Gordon Duff was on deck when the wave hit the ship.

He heard the skipper roaring a warning to hold on, and just had time to look up and see what the warning was about. He was engulfed in solid water and swept against the safety bars.

George Duff was given mouth-to-mouth resuscitation for 20 min before he was revived. Conditions prevented a helicopter taking him off.

Gordon Duff said he believed Clark's body had floated because the man's habit of wearing a belt and elastic bands round his trousers had given him greater buoyancy.

Mr. Brechin was on the bridge when he looked up and saw the waves that looked like a big green cliff coming toward them on the port quarter.

The inquiry was told that in the morning and the previous night the weather had been fine--the calm before the storm.

As the weather got worse the skipper decided to head for shelter after talking to his sistership, the side trawler JAPONICA, which was the first boat on the scene to help with the search for the three men. Another fishing boat, the SUNBEAM also joined the search.

NEW COAST GUARD COMMANDANT

Secretary of Transportation Drew Lewis announced that President Reagan has nominated Vice Admiral James Steele Gracey to be the 17th Commandant

of the United States Coast Guard. The nomination was sent to the Senate for confirmation.

The 54-year old graduate of the Coast Guard Academy and the Harvard Business School succeeds Admiral John B. Hayes, who is retiring.

A 32-yr veteran of the Coast Guard, the new Commandant has served in assignments as varied as Commander of a LORAN (Long Range Aids to Navigation) transmitting station in an isolated Tlingit Indian village at Yakutat, Alaska, to Dangerous Cargo and Vessel Movements Officer at the Port of Boston.

Gracey moves up to the Coast Guard's top career position from an assignment as Commander of the Coast Guard's Atlantic Area and Third District, headquartered at Governors Island in New York City.

Admiral Gracey brings to the post of Commandant a wealth of experience in all phases of Coast Guard Command, and his expertise in the field of management, finance and training gives him a valued additional dimension.

The new Commandant was commissioned an Ensign on June 3, 1949 after receiving a Bachelor of Science Degree in Engineering, and was promoted to flag rank of Rear Admiral 25 yr later with command of the Ninth Coast Guard District in Cleveland. He was Chief of Staff at Coast Guard Headquarters when promoted to Vice Admiral and became Commander of the Pacific Area and Twelfth Coast Guard District in San Francisco. He was assigned to the Atlantic Area command in June of last year.

Prior to reaching flag rank, Gracey held numerous shore station assignments in the field of management, finance and training, as well as ship command--captain of the Cutter MARIPOSA.

RADAR SHOWS LINK BETWEEN WINDS AND SOLAR ACTIVITY

Scientists in the National Oceanic and Atmospheric Administration (NOAA) are exploring a possible link between solar activity and the earth's weather.

Using a powerful radar at Poker Flat, Alaska, researchers have found that when the auroral electrojet--a concentrated electric current circling the earth at high latitudes--is stimulated by an increase in solar activity, high-altitude winds speed up. This, perhaps, affects conditions in the earth's "weather layer," the lowest 10 mi of the atmosphere.

Scientists of NOAA's Environmental Research Laboratories in Boulder, Colo., discovered the relationship between the intensity of the electrojet and the velocity of winds about 50 mi above the earth's surface while testing the weather radar at the University of Alaska's research range. Funded by the National Science Foundation, the radar has an antenna area of nearly 10 acres and is designed to monitor winds, waves, and turbulence in the bottom 60 mi of the atmosphere.

As the Poker Flat radar recorded wind speeds, a second NOAA radar, in Fairbanks, and instruments at the University of Alaska, measured the intensity of the electrojet some 63 to 66 mi out in space.

On days when solar activity and the electrojet were quiet, the Poker Flat radar detected tides in the upper atmosphere, much like tides in the ocean. When solar activity and electrojet intensity increased, the tide-like pattern ceased and the high-altitude winds blew faster.

Scientists earlier recognized a relationship between solar activity and winds at altitudes between 60 and 72 mi. The NOAA team not only detected the effect much farther down in the atmosphere, but also perceived hour-to-hour changes where earlier studies had seen them only over periods of months.

Some researchers believe that waves moving up and down through the atmosphere could be one way high-altitude winds affect conditions influencing the earth's weather.

REPORT ON MISSING VESSEL POET

A Coast Guard marine board of investigation has listed three possibilities as the most likely causes of the disappearance of the general cargo vessel POET while crossing the Atlantic Ocean in October 1980. The vessel carried 34 crewmembers, all but two of whom were United States citizens.

The possibilities the board felt could have led to the vessel's disappearance were capsizing due to instability in rough seas, capsizing or foundering due to flooding of a hold, and loss of hull integrity. In his comments on the conclusions of the board, Coast Guard Commandant Admiral John B. Hayes said that significant credibility could be assigned to any of the possibilities, but he considered it more probable that some loss of hull integrity occurred.

The age of the ship, the fact that it had deferred repairs to both underwater hull and topsides, and the severity of the storm the POET encountered were factors to be considered. As was noted by the board, if there was some loss of hull integrity, the vessel could have been taking on water which could have been unnoticed by the crew long enough to lead to the sudden loss of the ship by plunging, capsizing or foundering.

The POET departed Cape Henlopen, Del. October 24, 1980, destined for Port Said, Egypt. The Coast Guard was notified by the owners November 3 that the POET had not been in contact with them since its departure. After unsuccessful attempts to establish communications, an air and sea search was conducted from November 8 to 17, covering 296,000 sq mi. The search proved unsuccessful. No trace of the vessel, crewmen, or debris was found.

MERCHANT MARINE ACADEMY

The appointment of Captain Thomas J. Patterson, Jr., as Deputy Superintendent of the U.S. Merchant Marine Academy, Kings Point, N.Y., has been announced by Admiral Harold E. Shear, USN (Ret.), Maritime Administrator. Patterson is a 1944 graduate of the academy.

In his new position, he will hold the rank of Commodore, U.S. Maritime Service (USMS), and report to the Superintendent, Rear Admiral Thomas A. King, USMS. He replaced Commodore Howard F. Casey, who retired at the end of February.

Since 1970, Patterson has been Western Region Director of the Maritime Administration. Operat-

ing from regional headquarters in San Francisco, he has been responsible for MarAd programs in 15 western states, including Alaska and Hawaii.

Patterson joined MarAd in 1962 and held posts involving ship operations before his appointment to head the agency's regional office.

A deck officer with Keystone Shipping during and after World War II, Patterson holds a ship master's license. He was commissioned as Ensign in the U.S. Navy in 1944. He served on active duty with the Navy from 1950-57, including command at sea.

In addition to receiving his Bachelor of Science degree from the U.S. Merchant Marine Academy, Patterson has attended the University of Pennsylvania and the Drexel Institute of Technology. He is a native of Philadelphia.

COLLISIONS IN FOG

The National Transportation Safety Board issued reports on the collisions in fog of the LASH ATLANTICO and HELLENIC CARRIER and ferry AMERICAN LEGION and HOEGH ORCHID. The investigation contained several similarities in the two collisions. In both cases vessels were operating at excessive speed for the visibility, there was ineffective use of the radar, particularly plotting of relative movement, and lack of radio communication and coordination between ships involved.

Fog in itself is not dangerous but the restricted visibility, long stopping distances and turning radius calls for extreme care and alertness.

MARINE WEATHER REVIEW

The Weather Logs combined with the cyclone tracks, U.S. Ocean Buoy climatological data, gale and wave tables, and mean pressure patterns are a definitive report on the weather systems and primary storms which affected the North Atlantic and North Pacific Oceans during this 3-mo period. Hurricane Alley lists and describes tropical cyclones worldwide. Unless stated otherwise, all winds are sustained winds and not gusts; all times are G.M.T.

North Atlantic Weather Log

October, November and December 1981

WEATHER LOG, OCTOBER 1981--There were about the usual number of extratropical cyclones this month. Their favorite path was from the Great Lakes east-northeastward to midocean near 50°N, 30°W, then northeastward to the Shetland Islands and along the coast of Norway. There was a secondary track from near the Azores through the English Channel. These differed markedly from climatology, which shows several primary tracks, one of which forms off the U.S. East Coast to Iceland. The storms formed farther north and traveled a more easterly path.

The mean storm path was reflected in the mean pressure pattern. The Icelandic Low was 998 mb centered off Nordfjord, Norway, about 1,000 mi east of its climatic location. There were three shallow LOWS over the Labrador Sea and Hudson Bay. The Azores High was near 38°N, 29°W slightly north of its climatic location and 5 mb stronger at 1024 mb. A weak high pressure center was over the U.S. central East Coast (fig.24).

The anomalous position of the Icelandic Low resulted in two large anomoly centers, one negative and one positive. The minus 11-mb center was east of Oslo, Norway. The plus 14-mb center was near 60°N, 35°W, very near the climatic position of the Icelandic Low.

The low center of 700 mb was also shifted eastward to the Norwegian Sea, with the long wave trough paralleling the Greenwich meridian.

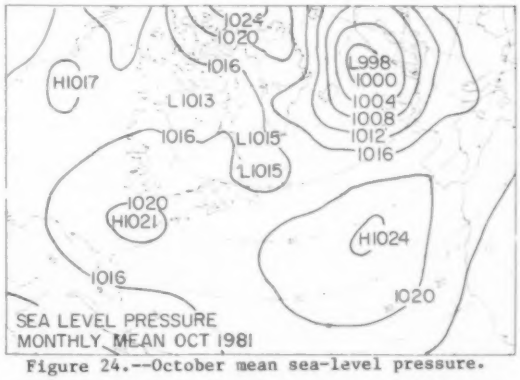


Figure 24.--October mean sea-level pressure.

There was a ridge over the west coast of Greenland and a short wave trough off the southeast coast of the United States.

Tropical storm Jose formed on the 29th. See Hurricane Alley and tropical cyclone annual article in Winter 1982 issue.

Extratropical Cyclones--Several low pressure centers had moved through this area off the Iberian Peninsula on the 3d and 4th. This storm formed on the 4th near 40°N, 20°W in the trough of one that had come out of Newfoundland. The LACKENBY near 48°N, 22°W

reported 44-kn winds and 26-ft waves in the northerly flow. The CHOKO MARU to the northwest also found 26-ft waves. On the 5th at 1200 the GEESTSTAR (41°N, 25°W) reported 62 kn northwest winds. The storm was moving northeastward and quickly died out on the 6th.

This storm had a long life. It formed on a point of occlusion over Long Island on the 2d. It rapidly intensified and moved northward to central Quebec. On the 4th the MANHEIM near 43°N, 55°W encountered the front with a frontal wave and suffered with 45-kn southerly winds and 26-ft seas.

The storm center stalled for 24 hr near 52°N, 68°W on the 4th and 5th and weakened. By the 6th it was traveling eastward with the zonal flow. At 1200 on the 8th, the ALBRIGHT EXPLORER (50°N, 20°W) found 46-kn winds and 23-ft seas. The TFL LIBERTY measured 51-kn winds and 20-ft seas west of Lands End. The drilling rig KINGSNORTH UK narrowly missed going aground on the 9th in the Shannon Estuary after her towline parted in winds up to 65 kn. Ten people were injured when the ferry EARL GRANVILLE ran into heavy seas in force 10 winds off the Isle of Wight, also on the 9th. Several cars broke loose. The DONIA lost a liferaft and windows were smashed off Lands End.

At 1200 on the 10th the storm was centered near 63°N, 01°E at 970 mb. Platforms and ships on the North Sea were reporting winds near 50 kn and seas near 20 ft. On the 11th there were winds reported up to 65 kn and waves to 26 ft. The LOW was stationary off the coast of Norway on the 11th and 12th. On the 13th it was absorbed by another system off Nordkapp.

This storm came off the eastern slopes of the Rocky Mountains on the 5th. The center was over Lake Michigan at 0600 on the 6th. As the 988 mb center moved east of the lakes the northwest flow brought strong winds to Lakes Huron and Erie. Four ships measured winds between 42 and 48 kn with waves up to 8 ft. The JOHN G. MUNSON had 48 kn on Lake Huron. The storm disappeared south of Cape Race on the 11th.

This LOW formed at the point of occlusion as it passed over Kap Farvel on the 16th. It moved into the Denmark Strait and started moving eastward on the 18th and strengthening. Fishing vessels near Iceland reported 45- to 50-kn winds and a Norwegian vessel reported 39-ft seas near 68°N, 20°W. By 1200 on the 19th the storm was 968 mb north of the Faeroe Islands. Several platforms between 54°N and 61°N and 1°W and 4°E had southerly winds near 60 kn with seas as high as 36 ft. The tug VERRICOS GIORGOS towing two other tugs from Liverpool to Greece fouled its propeller on a tow rope and they were blown ashore on southeastern Wales (fig.25). There were no injuries as helicopters rescued the crewmen. There were no high wind reports on the 20th as the winds shifted to the north and the center combined with another over Denmark and moved out of the area.

Figure 25.--Three tugs on the rocky coast of Wales. The VERRICOS GIORGOS is in the right foreground. Wide World Photo.

This frontal wave quickly developed into a full blown storm and as quickly deteriorated. At 1200 on the 18th it was centered near Sault Ste Marie at 980 mb. At 1800 the IRVING S. OLDS on Lake Erie found 55-kn westerly winds and 10-ft seas. At 0000 on the 19th the JOHN G. MUNSON measured 47-kn winds with 15-ft seas on Lake Huron. A few hours later the center shifted to near Ungava Bay. This new center traveled northward and a ship in Davis Strait had 52-kn southerly winds. The storm gradually deteriorated over Foxe Basin.

A front stretched along the Appalachian Mountains on the 22d. A wave formed on the 23d and this storm was born. The strongest of the month over this ocean. The storm strengthened rapidly as it crossed Labrador on the 25th. The IMPERIAL ST. CLAIR (54°N, 56°W) was within 4 mb of the center with 56-kn winds at 0000. At 1200 a Danish ship near 59°N, 44°W reported 68-kn winds with 23-ft seas. The storm was 978 mb only a few miles to the south.

There were many reports of winds near 50 kn with waves over 20 ft during the 26th. The ARCTIC had 65 kn near 59°N, 25°W and LIMA measured 55-kn with 33-ft seas. On the 27th LIMA measured 28-ft seas. CHARLIE was receiving 20-ft seas. The storm stalled near the southeast coast of Iceland on the 27th. There were high swell waves up to 30 ft south of the center as far south as ROMEO. The storm persisted until the 29th with winds less than gale force.

Casualties--The following casualties were due to fog. The JEAN PARISIEN grounded at American Narrows. The KWAI and ST. LOUIS collided at Algeciras. The ANI and TITANUS made contact at Venice. These vessels were involved in groundings: the NORDSTAR in the southern Baltic Sea, the ANDRIES off Genoa, the APEX CHICAGO and tug MAYA off Rhode Island, and AFRODITI P. and tug MANSCO.

Heavy weather damaged the following vessels: ARGLL, ELMANI, floating dry dock No. 4, another dry dock under tow off False Cape, MELTON CHALLENGER, AGIOS IOANNIS, MARMARAS, GIANNIS M., SKIFJORD, CHIOS AEINAFTIS, and the NADINE contacted the VERGINA, SEISHO MARU, and NORDWEST

in the Kiel Canal.

A crewman was lost from the I.D. SINCLAIR in mountainous seas in the English Channel on the 11th. Two men were lost overboard from the ARCTIC on the 26th plus heavy weather damage on a voyage from Antwerp to Nanisivik.

WEATHER LOG, NOVEMBER 1981--The storms followed the primary over water normal path well this month. It stretched from off the east coast of the United States to the Faeroe Islands and the Norwegian Sea. There was an anomalous series of storms over the Azores. A primary path from the Great Lakes into the Labrador Sea was missing, as were secondary paths across the British Isles into Sweden and across northern Italy.

The mean pressure pattern in the northern latitudes and around the Icelandic Low were near normal, except the lowest pressure was near 75°N, 15°E rather than between Greenland and Iceland. There also was a third center southwest of Kap Farvel. The center of the Azores High at 1028 mb, 9 mb above normal, was shifted to near Bordeaux, France. This brought much higher pressures to Europe and the Mediterranean. A 1020-mb subcenter of the High was slightly west of its usual 35°N, 33°W location. The LOWs over the Azores reflected a 1018-mb depression over that area (fig. 26).

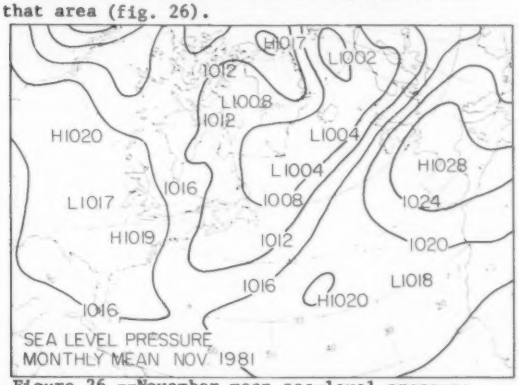


Figure 26.--November mean sea-level pressure.

The most significant anomaly was plus 13 mb over western France. It influenced the weather from latitude 60°N south into Africa and as far west as longitude 30°W along 50°N. There was an area of minus pressures off the North American coast with a 6-mb center east of Nova Scotia.

The upper air flow at 700 mb was primarily zonal from Florida to Labrador to the English Channel to Iceland. There was a deep trough west of Spain with a sharp ridge over Spain.

The Atlantic hurricane season ended with Katrina and a total of 11 tropical cyclones, and one subtropical cyclone. See the Winter 1982 issue for the annual article.

Extratropical Cyclones--Frontal waves were traveling along a front that stretched southwestward from Ireland. On the 2d one of these waves and tropical storm Jose combined. At 1200 the ABBEY (48°N, 26°W) had 52-kn winds. At 0000 on the 3d the 970-mb storm was very near Lima (971.6 mb), which had 45-kn winds and 15-ft seas. At 0600 she had 60 kn with 21-ft seas. The seas were 30 ft at 1200. Fishing vessels south of Iceland had winds up to 68 kn but as usual didn't report waves. By the 4th the platforms near the Shetland Islands had 45- to 55-kn winds with waves up to 30 ft. These continued through the 5th as the storm moved over Scandinavia.

As a LOW moved over Hudson Bay another center formed over Ungava Bay on the 2d. By 1800 a Canadian ship VCPK (49°N, 66°W) had 58-kn winds. On the 4th at 0000 the FREDERICK CARTER (47°N, 60°W) had 55 kn. At 1200, the SHIRLEY LYKES (43°N, 46°W) found 58 kn. A ship at the front had 20-ft waves. The storm was 974 mb near 57°N, 54°W. CHARLIE measured 47-kn winds with 21-ft seas just before frontal passage. On the 5th other centers formed that weakened this one as it moved to Greenland's southeast coast.

This storm was a combination of several low centers as the energy transferred from one to another. Most of the heavy weather was near the front. On the 7th a LOW was moving eastward over Maine and a second LOW was moving northeastward off Cape Hatteras. The TYNEBANK (38°N, 58°W) found 55-kn southerly winds with 30-ft waves at the warm front. On the 8th the second LOW combined with the first. Extratropical Katrine was near 30°N, 62°W. A Saudi ship to the northeast found 23-ft waves. Ships near SEDCO were reporting 45- to 53-kn winds. The LUDWIGSHAFEN EXPRESS (38°N, 54°W) east of a frontal wave had 52 kn with 33-ft swells. A ship to the north had 23-ft swells. The AMERICAN LEGACY (42°N, 59°W) was near a trough line with 25-ft waves. The combined center never developed and weakened as it traveled eastward and finally dissipated near Oslo.

The southwest U.S. produced this LOW. It traveled southeastward to the Gulf Coast and crossed Florida on the 11th. During this time it brought welcome rains. On the 13th it was off Cape Hatteras (fig. 27). Several ships had 40- to

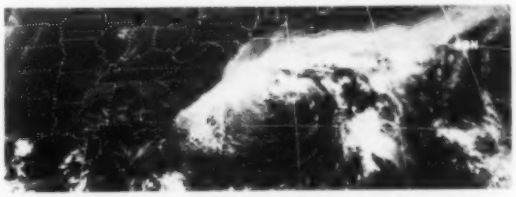


Figure 27.--A typical Cape Hatteras storm.

50-kn winds and waves up to 33 ft at 0000. At 1200 the JOHN CABOT (34°N, 74°W) had 45-kn northeast winds and 39-ft waves. At 0000 on the 14th the LOW was 996 mb near 34°N,69°W. The EXPORT FREEDOM northwest of the center had 45-kn northeast winds and 23-ft waves. Late on the 13th, a 300-ft tanker barge (fig. 28) was blown aground at Cape Charles, Va. The SEATTLE between Cape Hatteras and the storm's center had 56-kn winds. At 1200 on the 15th, the 984-mb storm was at 38°N, 72°W. The SEATTLE now reported 50-

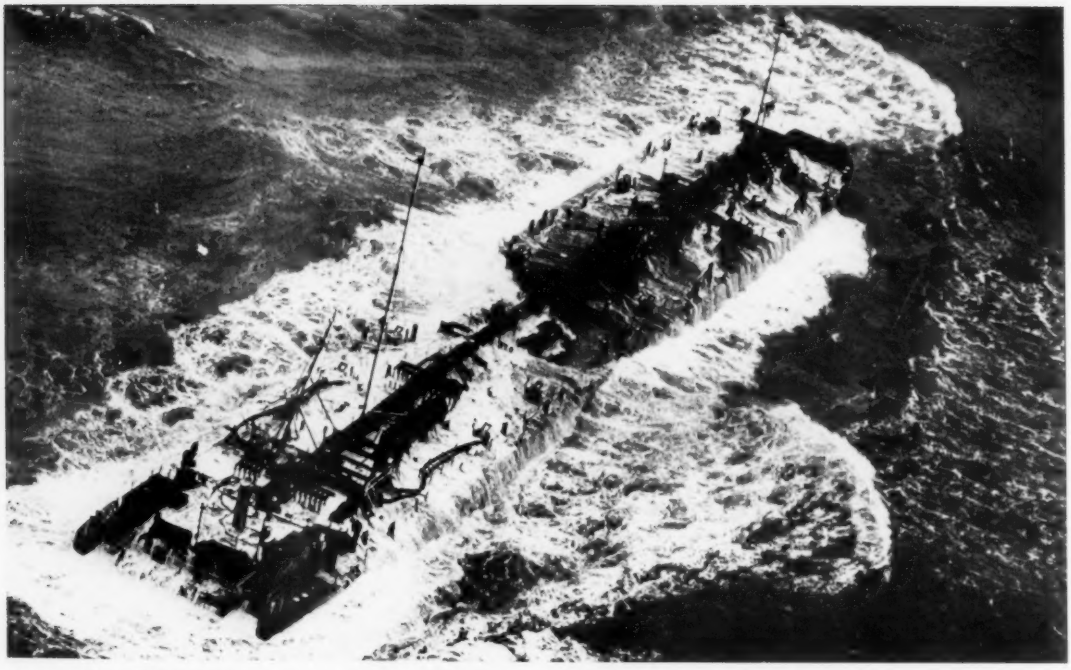


Figure 28.--The typical storm blew this 300-ft tanker barge aground near Cape Charles, Va. Wide World Photo.

kn winds and 20-ft seas. A ship (ELAX) (37°N, 73°W) was pounded by 60-kn winds.

By the 16th the winds were generally gale to storm force, but waves up to 30 ft persisted. Long Island was lashed by 60-kn winds. The storm weakened rapidly and disappeared on the 18th over Newfoundland.

This LOW could possibly have been a continuation of the previous LOW. It moved eastward from the central ocean east of Newfoundland and expanded. At 1200 on the 20th it was over the North Sea at 972 mb. Platforms were reporting up to 52-kn winds and 25-ft seas. By 1800 the high wind and wave reports had blossomed. The highest winds and waves were near 56°N. The GRHJ (56°N, 02°E) reported 68-kn winds with 29-ft seas. At 0000 on the 21st a Japanese registered reporter near 60°N, 02°E also had 68-kn winds and 30-ft seas. By 1200 the storm was over the Gulf of Bothnia.

Monster of the Month, North Atlantic--This LOW formed in nearly the same place as the previous one, only 36 hr later. By 1200 on the 21st strong winds were being generated in the southeastern quadrant and the storm slowed. The storm suddenly deepened on the 23d and at 1200 was 975 mb near the Faeroe Islands. The storm brought very severe weather to England, North Sea, Denmark, and West Germany. Wind gusts up to 70 kn hit Measeyside, where a 75-ft-long and 12-ft-high wall was blown over on five vehicles. On the 24th the oil production platform TRANSWORLD 58 (cover) broke loose from its anchors in winds up to 78 kn and seas reported to 40 and 50 ft. Tugs got lines on the rig and under control on the 25th. Rescue helicopters took 48 of the 70 crewmen off. No lives were lost. The Norwegian supply rig PHILLIPS SS broke loose from some of its anchors 30 mi to the north.

In Denmark 1,200 people were evacuated from the North Sea coast as it was feared that high seas and tides would break through the dikes. Lowlands in North Germany were flooded and ports closed. Several ships grounded and several sank. Two people died and 10 were injured in Sweden. A nuclear power station had to close. Ships involved were the METTE MOLS, FRAN MEELAD STENFOSS, SERVIA SORSTRAND, ST. JOHN, POINTSMAN DIMA, MAERSK TRADER, PALMYRA, DAFFODIL B.,PARALOS, IBN BAJJAH, VIKING VICTORY, LOK NAYAK, VIKING III, and CLARKWOOD.

The highest winds reported over the North Sea appeared to be 80 kn and the waves 46 ft. This was by rigs at 60.5°N, 02°E and 61.5°N, 01.6°E.

The storm dropped to 964 mb at 1200 on the 24th over Sweden. Early on the 25th the storm had moved far enough east to relieve the gradient over the ocean areas.

A LOW moving into the Appalachian Mountains dissipated as this one formed over South Carolina on the 24th. By 1200 on the 25th it was 980 mb off Cape Hatteras (fig. 29). Buoy 41001 reported 26-ft waves. Winds at Cape Hatteras exceeded

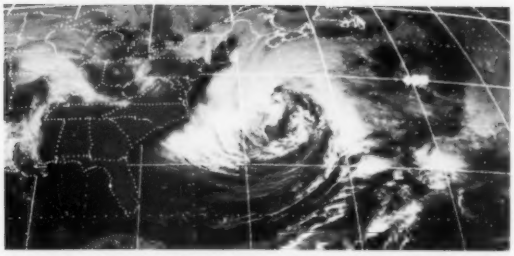


Figure 29.--Another storm that deepened rapidly in the vicinity of Cape Hatteras.

50 kn. Several ships had winds exceeding 50 kn and waves over 25 ft. The SANTA FE (33°N, 71°W) found 65 kn and 39-ft waves. The OLEANDER (36°N, 69°W) had 60 kn and 39 ft. By 1200 on the 26th the storm was 972 mb near 40°N, 57°W. The RESOLUTE (40°N, 63°W) found 55-kn winds and 36-ft waves. On the 27th the TFL EXPRESS measured 55-kn southerly winds near 44°N, 40°W with 20-ft waves.

The storm was tracking northward on the 28th and 29th. Its pressure reduced to 960 mb at 0000 on the 29th near Hamilton Inlet, but it weakened rapidly and disappeared 36 hr later.

The EURO PRINCESS was driven aground on Sable Island with high winds and heavy seas on the 26th. The 26 crewmen were rescued by helicopter. The ELMA TRES sank in heavy seas and gusts up to 70 kn about 215 mi east of Bermuda. Only one person was rescued, one body sighted, and 22 missing. The demasted yacht TINA was sighted during search for survivors of the ELMA TRES. The barge BFT No. 39 suffered damage during the storm.

Casualties--Owing to the many casualties this month this will only be a listing. See the individual storms for casualties that could definitely be associated with that storm. The AURORA contacted the JUNIOR K. Groundings included the: AIME GAUDREAU, ASPA II, BARGEMAN, FOLLA, ROLAND DESGAGNES, and VERONIQUE I.

The following ships had heavy weather damage this month: ANTAR, GIANT, ASIAN GLORY, PARALOS, STAR CASTOR, KATHLEEN, EASTERN SPLENDOUR, DART ATLANTICA, SABRINA, ENTERPRISE, ELISABETH BOYE, ALRATI, SILVER JOY, LAGO LLANQUIHUE, FATIMA, CLAIRE, HERMES, KOUDA, VELIKIY USTYUG, ANNIKA N., RIVER HADEJIA, MARIAM I, MONTERREY, SEA-LAND EXPRESS, AFRICAN ADDAY, and SANTA FE II.

The GLOBE ASIMI grounded off Lithuania and broke up on the 21st. The NAROS sank off Scheveningen on the 29th.

WEATHER LOG, DECEMBER 1981--The primary mean storm tracks were vastly different from climatology, indicating a major difference in the mean pressure pattern from climatology. The normal shows two primary tracks; one southeastward over the Great Lakes curving northward near Cape Cod and into Davis Strait; the other originates east of Nova Scotia and traces a path northeastward to Iceland. This month there was a minor path northeastward over the Great Lakes. The major paths were eastward from Cape Hatteras to longitude 35°W; and from near Long Island

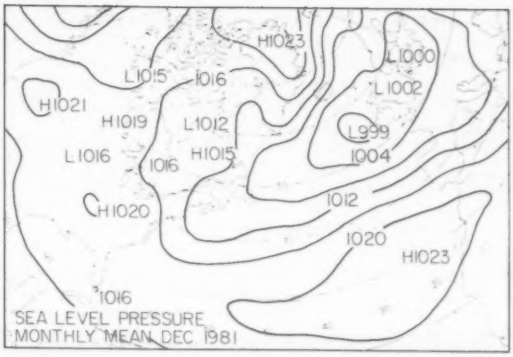


Figure 30.--December mean sea-level pressure.

northeastward to Newfoundland then eastward to the English Channel. Another major path was north of the eastern Mediterranean.

The Icelandic Low was southeast of its usual location. There were three centers; the primary (999 mb) was near Rockall Bank, a 1002 mb over the North Sea, and a 1000 mb near the Gulf of Rija. The central pressures were within 1 mb of normal. The Azores High at 1023 mb was 2 mb higher than normal and 400 mi to the south near 30°N, 25°W. There was a sharp trough along the U.S. East Coast (fig. 30).

The anomalies were largely due to displacement. There were three significant negative centers: a 12 mb over Poland, a 11 mb near Brest, France, and a 5 mb near Sable Island. The primary positive anomaly was 12 mb elongated along the east coast of Greenland.

The primary 700 mb LOW was north of Hudson Bay not far, but south, from its climatic position. There was a large sharp ridge over Greenland. There was an anomalous deep sharp trough over Finland into the Baltic Sea. Between latitudes 30° and 50°N, the flow was zonal between the two continents.

There were no tropical cyclones, and none are expected.

Extratropical Cyclones--A persistent HIGH west of France had stalled a north-south front with frontal waves moving northward. Another HIGH moved off the U.S. East Coast. This squeezed one of the frontal waves southward on December 2. By 1800 the EXPORT COMMERCE (38°N, 45°W) found 45-kn winds and 20-ft waves. At 1200 on the 3d the storm was 1000 mb near 33°N, 40°W. A cut-off LOW had formed aloft and was at 30°N, 40°W. The GOSPIC (34°N, 25°W) found 60-kn east winds, and the SCYTHIA (34°N, 35°W) had 45-kn winds with 30-ft swells. A ship on the west side of the storm near 45°W also had 45-kn winds and 26-ft waves out of the north. The storm had moved southwestward and at 1200 on the 4th was near 28°N, 45°W. Several ships north of the center had strong gales, and one at 37°N, 38°W found 33-ft easterly swells. The LOW weakened on the 5th with two centers and the northern one moved northward while the other dissipated.

This LOW formed over North Carolina as another dissipated over western Maryland on the 4th. By

late on the 5th there were gales on the west side and at 1800 the EXPORT COMMERCE (31°N, 69°W) reported 65-kn winds with 41-ft swell waves. By 0000 on the 6th they were north at 70 kn with 52-ft swells. The storm was 970 mb near 38°N, 66°W. At 1200 there were three reports of 55-kn winds in the southwest quadrant with waves as high as 33 ft. On the 6th a ship near 36°N, 69°W radioed 60-kn west winds and 41-ft swell waves.

New England was hit by a severe blizzard. By the evening of the 6th up to 30 in of snow had fallen on parts of Rhode Island. Many areas had 1- to 2-ft of snow and winds gusting to 50 mi/hr (fig.31).

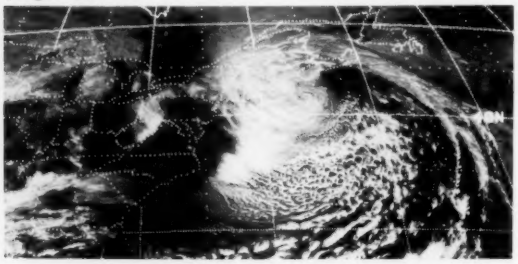


Figure 31.--At 1700 on the 6th the storm was centered south of Cape Sable.

By 1200 on the 7th the storm was 976 mb near Sable Island. There were several storm force reports with waves up to 33 ft south of the center. Twenty-foot swell waves extended 900 mi to the southwest.

The storm dumped up to 2 ft of snow on New England, the worst early winter storm since 1926 and worst winter storm since 1978. The highest reported depth was 40 in. Over 55,000 were without power and 55 died. About 200 people were stranded on Nantucket Island. The storm weakened on the 8th and dissipated on the 9th over Newfoundland as another LOW moved eastward out of New England.

A large high-pressure area over northern Canada and northern Greenland started building and pushing southward about the 7th. Isolated reports of easterly winds up to storm force and waves over 20 ft were found north of latitude 50°N. On the 10th small low-pressure systems began traveling eastward between latitudes 45° and 55°N. They separated two large HIGHS over Greenland and the Azores. By the 12th the HIGH over Greenland was breaking down, allowing larger and more severe LOWs to develop.

This storm was a combination and continuation of several of the LOWs mentioned above. A good place to start is with one that started late on the 11th off Cape Race. On the 12th there were several reports of strong gales north of the LOW. On the 13th this LOW dissipated and another burst forth west of Lands End. At 1200 the new LOW was 964 mb near Fastnet Rock. There were many gale and storm reports and waves up to 25 ft. The BRITISH AVON in Moray Firth had 60 kn, and the MINERAL LUXEMBOURG (49°N, 26°W) had 53 kn with 26-ft waves. On the 14th LIMA measured 58-kn with 31-ft seas that increased to 39 ft at 0600. This LOW was over the Low Countries by midday, but another from south of Iceland followed and kept up the pressure of winds up to 50 kn and waves up to 20 ft. This last LOW dissipated over England.

This storm resulted in many ship casualties and shore damage in the United Kingdom and France. Hurricane-force winds and deep snowdrifts caused chaos in Britain and Ireland. Temperatures dipped to record lows and power lines downed in southwest England, Wales, and Northern Ireland. On the east Kent coast seas lashed by force 10 winds resulted in extensive flooding. At Hythe and Sandgate waves 40 ft high swamped seafront cottages. A hospital at Hampshire was evacuated. Cowes had its highest tide in 60 yr. Storms in southwest France cut bridges and roads. Telephone wires were down. Rivers were at the highest level in 50 yr. Five hundred people were evacuated in the Tarn department. Families from 230 farms were evacuated by helicopter in another Department.

The following is a partial list of ships involved in this storm: RADCLIFFE TRADER, PESCADO, BONITA, WYGYR, ORLANDO, BOBRIX, MARIE ANNE DE BRETAGNE, HARRY MITCHELL, SOLVENT DISCOVERER, GRAINVILLE, FAL MEDINA, GERDA GRAEBE, ANCHORMAN, LADY BIRD, RIVER NGADA, and BALTIM.

Monster of the Month--This LOW moved southward along the east slopes of the Rocky Mountains, then along the Gulf Coast to near Cape Hatteras late on the 15th. At this point it blossomed. The OVERSEAS ULLA (36°N, 74°W) was sailing southward into 50-kn south winds and 26-ft waves. The low center was moving along the coast on the 16th and 17th. The GYPSUM DUCHESS and CG11 both had 60-kn winds. There were swell waves up to 28 ft on the outer southeast fringe of the storm. The LNG carrier EL PASO COLUMBIA broke tow in 40-ft waves and winds to 85 kn and went aground 1 mi southeast of Cape Sable Island (fig.32).

By 1200 on the 18th the 980-mb LOW was near 55°N, 50°W. The higher reported winds were

Figure 34.--The EL PASO COLUMBIA went aground near the lighthouse at Cape Sable. She was being towed, and it broke in 40-ft waves. Wide World Photo.

mostly gales and there were reports of 20- to 25-ft waves. The major feature of the storm on the 19th was high waves in the southwest quadrant up to 28 ft. By the 20th 50-kn southerly winds were south of Ireland and they reached the North Sea by 1200. There were a few 60-kn reports and the GBQC near 57°N, 01°E reported 70 kn out of the south with 20-ft seas and 39 ft swells. At 1800 the observer 3EPI reported 49-ft waves. The LOW was 968 mb near 59°N, 13°W. A deep trough extended to 35°N with waves over 20 ft on the western side. By the 21st the storm was weakening and the strong wind band was over the Norwegian Sea. MIKE measured 45-kn and 20-ft waves. The original LOW disappeared, and another center moved over the Greenland Sea.

This was a continuation of 2 weeks of bad storms over Britain. The 1,400-ton Irish UNION STAR (fig. 33), only 10 days old, had engine failure on the 19th off Tater-du Lighthouse. A lifeboat manned by eight volunteers rescued four people, but it and the ship both overturned in force 8-10 winds with gusts to 70 kn. All were lost.

About 30 people on shore died during this worst winter so far this century. Tens of thousands of homes were blacked out. The hands of Big Ben froze. The Queen was among 100 motorists forced to take shelter in a Cotswold Hills hotel. The EYRARFOSS and ANEL had heavy weather damage.

Figure 33.--The 1,400-ton UNION STAR lies overturned on the rocks of the southwest coast of England after her engines quit in this violent storm. Wide World Photo.

This was a very short-lived storm as far as the marine community was concerned. It formed west of the Bay of Biscay on the 22d. At 0000 on the 23d ROMEO measured 47-kn winds. At 1200 it was 976 mb off Brest. The TROLL PARK off Cape Finisterre had 52-kn winds and 31-ft seas. By 1800 the maximum winds had increased to 64 kn by the BRITISH HAZEL with waves coded as 40 (66 ft). Others were reporting to 33 ft, so maybe the waves should have been 40 ft, code 25. On the 24th the storm was over land.

As the last storm moved over France there were five other small LOWs north of latitude 40°N that were marine. The LOW of interest was first found as a wave on the 24th. By 0000 on the 25th the LOW had plunged from 992 mb to 960 mb in 24 hr near 59°N, 34°W. A LOW that 24 hr earlier was near Cape Sable was moving eastward along latitude 43°N. There were 20-ft wave reports with both storms and earlier 50-kn winds with the southern one. By 1200 there were 45- to 60-kn winds and swells up to 33 ft with the combined system. LIMA reported winds of 52 kn and CHARLIE waves to 28 ft. Winds of 40 to 50 kn and waves 20 to 30 ft south and east of the centers continued through the 26th. A buoy near 60°N, 16°W measured 56-kn winds. The SEA-LAND GALLOWAY (48°N, 34°W) found 45-kn winds and 26-ft swells.

The southern LOW dissipated on the 26th, and the northern LOW had turned northwestward toward Kap Farvel. Another frontal wave from Cape Hatteras was racing into the southern semicircle. The total storm covered the area from latitudes 35° to 70°N and the North Sea to Labrador. The higher winds were generally east of the front, and the higher waves south of the LOWs.

By 1200 on the 27th the new LOW was the primary center. The AMERICAN ACE, AMERICAN LEGEND, and SEA-LAND GALLOWAY were within a 120-mi area centered near 45°N, 43°W with 50- to 60-kn winds and waves up to 30 ft. The VRKC (47°N, 37°W) had 64-kn winds and 33-ft swells. At 1200 on the 28th the new center was 964 mb near 50°N, 18°W. LIMA to the north measured 45-kn winds with 20-ft waves. There were many winds over 45 kn and waves over 20 ft south of the LOW.

On the 30th another wave was moving through the southern periphery, and the higher winds and waves were temporarily associated with this center, which dissipated late in the day. On the 31st the storm was weakening and disappeared on New Years Eve.

This storm struck the Iberian Peninsula and Morocco hard. Ports in Portugal and Morocco closed due to winds over 55 kn. The MARINA DI EQUA sank off the northwest coast of Spain (fig. 34). Bridges over the Tagus River were closed. A floating crane capsized. The THANIC and CAREBEKA IX contacted. The LAKE BIWA lost anchor and chain at Casablanca, and the TEXISTEPEC had problems at Safi.

These ships had damage from the storm: RAVENSCRAIG, MYRTOS, CARBREEZE, JITEGEMEE, CAMPEA,

Figure 34.--This photograph of the MARINA DI EQUA was taken by French Navy aircraft just prior to her sinking after breaking apart in heavy seas. Wide World Photo.

GARINDA, RIO JALLAS, CARIBE MARINER, DANIA, MARIE P., FARADAY, and ALLIED ENTERPRISE.

This last storm of the month traveled cross country from off the Columbia River delta. It arrived on the East Coast on the 29th, very tired. As it moved over the Gulf Stream it rapidly regenerated. At 0600 of the 30th the CJR6 was slightly south of the center with 45-kn winds and 21-ft waves. At 1200 on the 31st the 964-mb storm was over the Virgin Rocks off Newfoundland. There had been several storm-force wind reports during the last 12 hr. One of the highest was 62 kn by the GVHY with 28-ft seas. By 1800 the AMERICAN ARCHER (43°N, 56°W) and the SEA-LAND ECONOMY (42°N, 51°W) both had seas over 35 ft with the latter reporting 41 ft. The TROLL PARK (34°N, 45°W) greeted the New Year with 49-ft waves. At 1200 the VCTG sent a report of 59-ft seas near 40°N, 46°W which had dropped to 49 ft at 1800. There were many storm reports with waves up to 30 ft.

This was another storm that covered a large part of the shipping lanes from Cape Race to Lands End and 30°N to 65°N. On January 2 the high winds decreased in number, but high swell wave reports persisted especially in the southwest quadrant. On the 3d a new storm moved eastward from Sable Island. On the 4th there was a long northeast-southwest low-pressure system with four centers.

The original LOW was one of the center ones and weakening, but there were still 50-kn winds and 33-ft waves to the north. The storm moved over the Irish Sea on the 5th.

Casualties--There were so many weather-related casualties this month that only a listing will be made. These are in addition to those that could be associated with a particular storm with some certainty. They were: AEGIS LINK, ALMIZAR, AMIRAL S. ALTINCAN, AUDACIA, AURORA, BELL ROVER, BENIL, BOLESLAWIEC, BRAVO NECK, CAVO SIDERO, CHALLENGER SERVICE, CHEMICAL CHALLENGER, DART ATLANTICA, FRANCESCA, GALILA, GAROUFALIA, HANNE DORTHE, HAPPY CHANCE, HUSSEIN, JUGO CARRIER, LA PALOMA, LIMA II, MANDO V, MARITIME GARDENIA, MERZARIO ARCADIA, MINI LATRIA, MONTAIGLE, MONTERREY, MONTE ZAMBURU, OCEAN KING, OFFSHORE CHALLENGER, OLIVER DRESCHER, PLOVDIV, REA, RIVER MAJE, SAGITTA, SAN GEORGE, SCANTIC, SEA RELIANCE, STAR CENTAURUS, STUYVESANT, SULU, TFL DEMOCRACY, TS 62 POWER, UNDEN, YONG MEN, ZIPI.

North Pacific Weather Log

October, November and December 1981

WEATHER LOG, OCTOBER 1981--There were two areas of concentration of storms this month, over the Sea of Okhotsk and from near 40°N, 170°E to Bristol Bay. There was a secondary concentration over the Gulf of Alaska. These areas were generally west of their climatic location. The area of cyclogenesis east of Japan was weak, and the climatic primary storm path missing. Two low pressure centers penetrated the Pacific High.

The mean sea-level pressure pattern for the month shows two low centers, one 1005 mb near the Kenai Peninsula, and the other 1007 mb over the Sea of Okhotsk. Climatology indicates one 1001-mb low center over the Kenai peninsula. The Pacific High was near normal at 1021 mb straddling latitude 35°N (fig. 35).

The two major anomaly centers were both 7 mb. One was plus 7 mb over the southern Gulf of Alaska with positive values covering the area northeast of a line from Mys Lopatka to Hawaii. The minus 7 mb center was over northern Manchuria. High pressure covered the Polar region with a plus 17-mb anomaly center near 85°N, 180°.

The 700-mb height pattern reflected the surface pressure pattern with two LOWs, one over Ostrov Sakhlain and the other near Nome, Alaska. The pattern over the midlatitudes was mainly zonal. A short-wave trough was reflected about 175°W and off the west coast of the United States. There were two tropical cyclones in the western ocean, tropical storm Fabian and typhoon Gay. In the eastern ocean there were four, tropical storms Lydia and Max and hurricanes Norma and Otis.

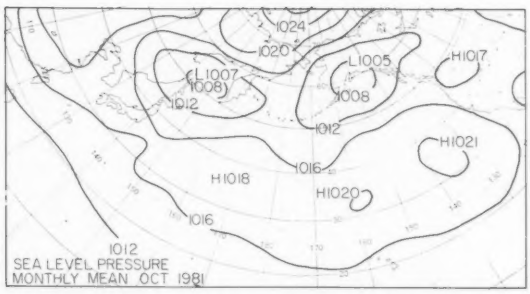


Figure 35.--October mean sea-level pressure.

Extratropical cyclones--This storm was the extratropical conversion of typhoon Elsie. At 1200 on the 2d she was still a tropical storm and the SEIAN MARU was within 30 mi of the eye. She reported only 35-kn winds with 20-ft seas and a pressure of 955.5 mb. Two hundred miles to the south a ship reported 41-ft waves with 50-kn winds.

By 0000 on the 3d the storm was extratropical at 952 mb near 46°N, 155°E (fig.36). There were many reports of winds greater than gale force in all quadrants of the storm. Wave reports of 20 to 30 ft were common. The HAURI MARU near 46°N, 154°E radioed a barometer reading of 941 mb with 57-kn northerly winds and 20-ft waves. The PINKSKY (47°N, 159°E) radioed winds of 64 kn from the southeast, 23-ft seas, and 57-ft swells. Several ships had winds near 60 kn. Winds over

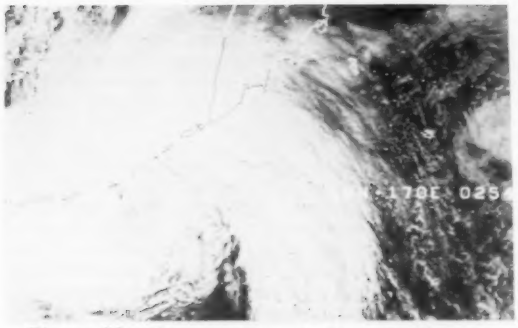


Figure 36.--There appears to be a small eye remaining near Ostrov Simushir at 0254 on the 3d, even though the storm was extratropical.

50 kn continued into the 4th with waves above 30 ft. At 0000 the SANKO LIGHT (48°N, 159°E) about 200 mi southeast of the 956-mb center reported 57-kn southeasterly winds and 43-ft waves. The southeast quadrant hosted the higher winds and waves.

By the 5th the storm was weakening with only gale-force winds, but the swell waves were still running over 20 ft in the southeast quadrant. At 1200 the pressure was only 985 mb, and a few hours later disappeared. This storm formed between typhoon Elsie, the Pacific High, and a HIGH over the Aleutians. It moved northeastward between the two HIGH centers and then turned eastward toward Vancouver Island. Another LOW was moving out of Alaska, southeastward over the Gulf of Alaska. Several ships including the WILMINGTON GETTY were in the Gulf with strong gales and seas up to 20 ft. Late in the day the SOUTH EXPRESS (53°N, 152°W) had 50-kn winds and 20-ft seas. At 0000 on the 6th the two centers had combined into one 960-mb center near 51°N, 136°W. The winds were still running up to 50 kn and a ship in the southwest quadrant found 33-ft seas and 36-ft swells. On the 7th the storm moved ashore near Cape Scott. Buoy 46005 reported 25-ft waves. By the 8th the storm had fallen apart.

One of the few storms to form in the area of primary cyclogenesis off Tokyo. It formed as a frontal wave on the 16th, and moved southeastward. By 0000 on the 18th the storm was 984 mb near 48°N, 168°E. Three ships reported winds over 60 kn south and southeast of the center. The THAMESFIELD had 65-kn winds and 41-ft seas. At 0600 her winds were 70 kn and seas 43 ft. The EDINBURGH UNIVERSAL nearby also had 43-ft waves. The high waves persisted and were still 33 ft on the 19th. The ships were traveling northeastward with the storm and in the same relative position. Other ships were finding waves over 20 ft in the southern half of the storm. By 1200 on the 19th the storm was 972 mb near 53°N, 173°W. At 1800 a ship at 50°N, 168°W had southerly 58-kn winds. The storm was weakening on the 20th, and on the 21st a new center took over.

The Tsugaru Strait produced this storm on the 18th. It traveled southeastward until the 20th, then gradually turned northeastward. The first significant gales started occurring on the 21st in the western quadrant near a secondary LOW. By 0000 on the 22d the two LOW centers had combined into one 968-mb center near 44°N, 176°W. Several ships now had winds of 50 kn and/or seas up to 30 ft. They were the PIKEBANK (36°N, 172°E), OGDEN SHANNON (34°N, 174°E), a Singapore ship (42°N, 165°W), and a Panama registered ship near 34°N, 174°W.

At 0000 on the 23d the storm was still 968 mb near 54°N, 168°W. The higher winds had now dropped to gales, but high swell waves persisted south of the center. The AMERICAN ASTRONAUT (40°N, 173°W) and the NANSHO MARU (48°N, 161°W) had 33 ft (fig. 37). The storm continued up the west coast of Alaska and dissipated late on the 24th.

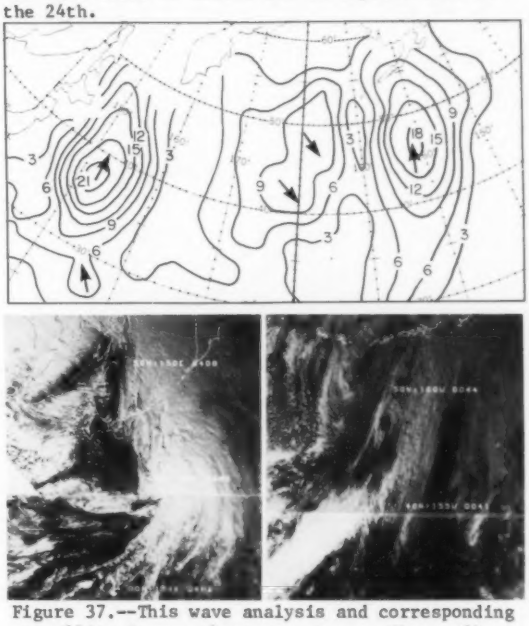


Figure 37.--This wave analysis and corresponding satellite images shows two storms. The swell wave reports were about twice the sea wave reports.

Monster of the Month--A large 1058-mb HIGH was centered over western Mongolia with a weak LOW moving around its southeastern edge. On the 21st it was over Manchuria, and typhoon Gay was south of Japan. This storm was a combination of these two cyclones. Gay was feeding warm moist air northward, and the extratropical LOW deepened rapidly. Late on the 22d Gay became extratropical, and ships near the Kurile Islands had winds up to 55 kn. By 0000 on the 23d the northern LOW (50°N, 141°E) was 959 mb and ex-Gay (37°N, 150°E) was 968 mb (fig.37). The NISSAN MARU (36°N, 149°E) reported 90-kn winds with 49-ft swells. The ISOKAZE MARU (39°N, 150°E) had reported 46-ft swells 3 hr earlier. The ship 3EED (37°N, 150°E) found 70 kn. Many had winds near 50 kn and waves over 20 ft.

By the 24th Gay had disappeared. A Soviet ship

near 41°N, 145°E had 55 kn and 26-ft waves. A Korean ship (50°N, 171°E) had 30-ft waves. Late on the 24th and early on the 25th there were a few isolated swell waves over 20 ft far to the south and east of the center. By the 26th the storm didn't exist.

This storm consisted of a quasistationary LOW over the Gulf of Alaska from the 26th through November 1, with several other LOWs moving through its circulation. Ships reported winds up to 50 kn and waves over 20 ft intermittently throughout the period. At 1200 on the 26th the ARCO ANCHORAGE (49°N, 134°W) had 50-kn winds. On the 27th the CGC MUNROE measured 50-kn winds south of Saint George Island. The circulation stretched as far south as latitude 30°N on the 28th. The SEA-LAND VOYAGER measured 42 kn with 16-ft swells not far from buoy 46006, which measured 30 kn with 20-ft seas. On the 29th the OCEANOGRAPHER near 60°N, 170°E measured 46-kn winds and 20-ft waves, which increased to 50 kn and 25 ft on the 30th. At this time a frontal wave was approaching Dixon Entrance. The WESTWARD VENTURE was between the 980-mb center and the coast with 45-kn winds. The OVERSEAS NEW YORK had 50-kn and 18 ft waves. On November 2 the LOW disappeared over the south coast of Alaska.

Casualties--The SHUI HONG 501 ran aground near the Pearl River on the 4th. The 29 crewmen escaped by lifeboats. The DONG JIN No. 5 dragged anchor and grounded south of Busan. A freak wave driven by 85-kn winds crashed over the fishing vessel JEANNA MARIE, destroying the wheelhouse. The 11 men abandoned the vessel and spent 54 hr in a liferaft with no provisions before being rescued by the SEA PRINCE.

The following vessels reported heavy weather damage during the month: ALVA SEA, ARAUCO, CAPTAIN HOOK, COLOMBIA LAND, COASTAL CORPUS CHRISTI, FOUNTON GRANGE, IRON YORK, JUNYO MARU No. 1, MAIN EXPRESS, SAN JUAN, VAN CONQUEROR, and VELA.

Other Casualties--The BARGE 358 sank off Bombay. The LASH BARGE 822 capsized at Kandla, India. The SURMAR ONE struck the pier in strong winds at a Chilean port. The landing barge ULUSAGHE had the steel ramp door torn from the hinges in high seas off New South Georgia. The IRON SIRIUS was at Port Kembla with weather damage.

WEATHER LOG, NOVEMBER 1981--There were two primary mean storm paths this month. One was from the La Perouse Strait to southwest Alaska. The second was from east of Tokyo eastward to mid-ocean, then northeastward into the Gulf of Alaska. Near 150°W this path forked eastward to Vancouver Island. From the vicinity of 37°N, 140°W various storms approached the U.S. West Coast. These matched climatology fairly closely.

The mean pressure pattern also matched climatology fairly closely. The Aleutian Low had two centers; a 996-mb near 56°N, 150°W and a 998-mb near 53°N, 166°E. This created an elongated east-west chicken leg shaped pattern. The climatic pattern is more oval shaped with a third center near 165°W. The primary center of the Pacific High was 1022 mb and shifted 25° longitude westward to near 32°N, 165°W. All centers were more intense than normal (fig. 38).

There were three primary anomaly centers, one near each primary pressure center. There was a minus 7-mb center over the Gulf of Alaska (55°N, 145°W), another minus 8 mb on the southwest coast of Kamchatka (53°N, 155°E), and the third plus 4-mb center near 32°N, 167°W.

The 700-mb pattern between latitudes 30° and 50°N was zonal except off the North American coast, where it curved northeastward to form a ridge over the mountains. There were two anomalous LOW centers matching the surface LOWs. The HIGH between latitudes 20° and 30°N was more intense, producing a tighter than normal gradient.

There were three tropical cyclones over the western ocean, hurricanes Hazen and Irma and tropical storm Jeff.

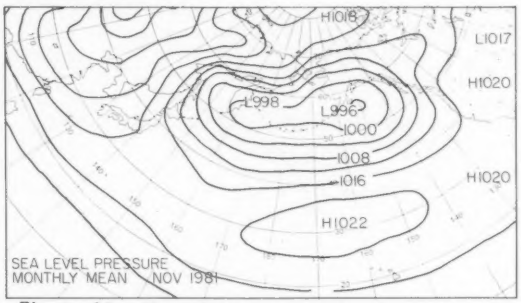


Figure 38.--November mean sea-level pressure.

Extratropical Cyclones--This LOW formed on the eastern edge of another LOW that had tracked across the Sea of Okhotsk. The EASTERN FORTUNE (46°N, 169°W) near the point of occlusion found 20-ft seas and 26-ft swells. At 1200 the MARIA RUBICON (52°N, 160°W) measured only 30-kn winds out of the south, but her swell waves were 39 ft, which continued into the 7th. At that time the PAC BARON (54°N, 159°W) had 50 kn and 33-ft waves. By 1200 the storm was 970 mb near 55°N, 165°W. On the 8th the ENNA G (37°N, 168°W) was far south of the center with 33-kn winds and 33-ft waves. At this time a frontal wave was moving through the southern periphery and gaining strength at the expense of this storm, which circled around the Bering Sea until the 11th.

Although two LOWs, this should be considered one storm. Both LOWS were formed on the 7th, one east of Tokyo and the other near midocean. On the 8th the SEALAND MARINER was west of the eastern LOW, partially in the circulation of the previous storm with 50-kn winds. A Japanese ship west of the western center had 40 kn. On the 9th, several ships had winds of 50 kn or greater. Among them the GENISTA (51°N, 144°W) and the EASTERN FORTUNE (48°N, 145°W) measured winds of 50 and 56 kn, and both had 33-ft waves. The PRESIDENT TYLER was involved with the western storm with only 35-kn winds, but the waves were 33 ft from the west. During the day several ships had winds over 60 kn, including the STARMAN ANGLIA (44°N, 151°W) with 65 kn and reported waves of 57 ft (code 35); 6 hr later they were 56 ft (code 34).

On the 10th the eastern LOW had turned northward with the western center traveling eastward to the south and reverting to a trough. At 1200 the eastern, now northern LOW, was 944 mb, and the overall circulation covered the northeastern ocean from latitude 30°N to the Arctic Ocean and the North American coast to Kamchatka. The CORNUCOPIA was just south of the Kenai Peninsula when she encountered 50- to 55-kn winds with 25- to 33-ft waves on the 10th and 11th. Her barometer (fig. 39) dipped to 960 mb on the 10th, rose slightly, then dipped to 957 mb on the 11th. Winds of 60 kn or more were reported by the GOLDEN ORCHID, CHEVRON CALIFORNIA, EXXON NEW ORLEANS, TAIWAN MAHOGANY, and a SHIP. These wave reports were up to 43 ft. They were in the southerly to westerly wind regimes.

On the 11th the western LOW had turned northward and became the primary center as it rejuvenated. Ocean swells up to 25 ft hit the northern California coast. The ARCO JUNEAU found 60 kn and waves of 49 ft near 50°N, 137°W. By the 12th only the latter LOW remained. There were 20-ft swells along the Washington coast. The storm was weakening and was gone on the 14th.

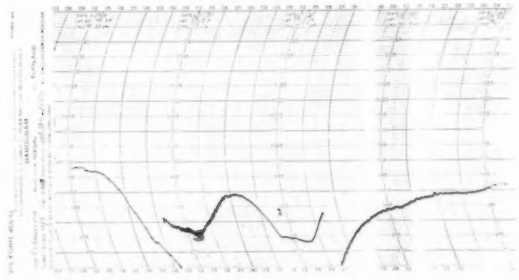


Figure 39.--The barometer trace from the CORNUCOPIA.

Monster of the Month, North Pacific--A fast developing and short-lived marine storm. Two seemingly insignificant ship reports identified the formation of this frontal wave. It raced eastward with explosive deepening late on the 13th off Cape Blanco. At 0000 on the 14th it was 956 mb, dropping 37 mb in 12 hr (fig. 40). The AMERICA MARU measured 60 kn at 1800 on the 13th. On the 14th several ships measured 60-kn winds, and the B. T. ALASKA measured 90 kn near 42°N, 128°W with 33-ft seas, and 39-ft swells. Not far away (42°N, 127°W) the CHEVRON CALIFORNIA

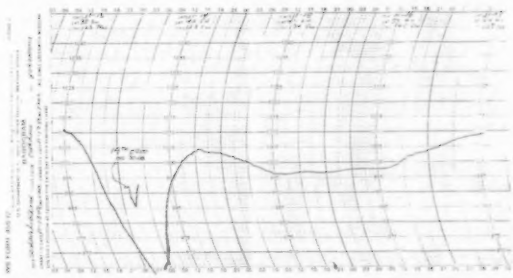
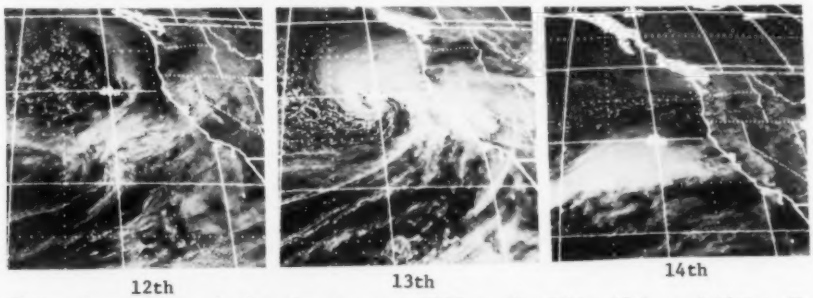


Figure 41.--This barogram from the SEA-LAND LIBERATOR shows the depth and gradient of the storm.

estimated 95 kn with 23-ft waves. The SEA-LAND LIBERATOR near 42°N, 127°W had 50- to 60-kn winds and waves up to 39 ft. The barometer (fig. 41) dipped to 956 mb, falling 28 mb between 2100 on the 13th and 0300 on the 14th. It also rose 14 mb between 0900 and 1200 that same day. The PRESIDENT CLEVELAND in the same area (42°N, 125°W) had 60-kn winds and 41-ft waves. Indicating the steep gradient, her barometer only went to 972 mb. The storm moved ashore late on the 14th over Cape Flattery and continued eastward across Canada.

Gusts as high as 57 kn with very heavy rain lashed the central and northern California coast on the 13th. San Francisco measured winds of 40 kn gusting to 55. By the 14th winds reaching 65 kn, producing 20- to 30-ft waves, hit the Oregon and Washington coast with storm warnings for the coast from San Francisco to Cape Flattery. A Coast Guard pilot was killed when his helicopter crashed off the Oregon coast in 60-kn winds and 30-ft seas while searching for a missing fishing boat. A Washington man was electrocuted by downed power lines. Seattle measured winds of 57 kn. See the front cover of the November-December 1981 issue.

The AMERICAN SPIRIT broke her mooring at Portland and grounded after colliding with the EXXON HOUSTON and a U.S. Navy Barracks barge. At Longview, Wash., the ATROPOS ISLAND dragged her anchor and struck the CYNTHIA and barge MIAMI. The tug WILLAMETTE HUSTLER and a three-section barge sank. The AJANTA collided with the O. G. MARU at Astoria. The EXXON SAN FRANCISCO broke her moorings on the 15th at Swan Island, Oreg., and collided with the barge CERES. The NEMESIS



12th 13th 14th

Figure 40.--These three images depict the storm at 2045 on the 12th, 13th, and 14th. The storm's center is over British Columbia on the 14th, and was near 37°N, 150°W on the 12th.

dragged anchors in the Columbia River on the 14th and collided with a pier.

Another frontal wave developed on the 19th. This one deepened fairly rapidly with some gales and 20-ft waves on the 20th. On the 21st several ships had winds over 40 kn. The KEYSTONE CANYON called the winds at 25 kn near 48°N, 131°W, but the swell waves were 38 ft. The AENEAS (45°N, 144°W) had 56-kn west winds and 41-ft waves. At 0000 on the 22d the storm was 970 mb near 52°N, 139°W. There were many reports of waves over 20 ft in the southern half of the storm, and the TOYOTA MARU No. 10 (46°N, 145°W) had 30 ft. The storm weakened on approaching the coast on the 23d.

A trough deepened over Sakhalin Island and this LOW resulted. On the 22d the PRESIDENT MCKINLEY (50°N, 160°E) had 50-kn winds and 23-ft swells about 350 mi south of the 980-mb center. The storm was 958 mb near 53°N, 175°E at 0000 on the 23d. The OGDEN CONGO (52°N, 180°) had 45-kn winds and 41-ft swells. The SPRAY STAN (53°N, 171°E) had 56-kn north winds and 30-ft waves. A frontal wave to the south was producing strong gales and waves over 20 ft. Her winds were 68 kn, seas 30 ft, and swells 39 ft on the 24th in the southwest quadrant. Another ship near 52°N, 179°E had 48-ft swells. This LOW raced into Norton Sound as another storm followed.

The Amur River valley spawned this storm. The LOW crossed the Kurile Islands on the 24th. This LOW plus the last-described LOW and another in between resulted in an elongated circulation that stretched from Hokkaido to Anchorage. The OGDEN SENEGAL (41°N, 147°E) had 50-kn west winds and 26-ft waves. There were other 40- to 50-kn winds and waves 20 to 25 ft in the westerly flow. At 0000 on the 25th the 964-mb storm was near 49°N, 164°E. The SPRAY STAN (49°N, 160°E) reported winds as 83 kn with 30-ft seas and 39-ft swells. Twenty-four hours later and farther southwest she was reporting 54-kn winds, 33-ft seas, and 39-ft swells. The QUEENS WAY BRIDGE (54°N, 179°E) radioed 64-ft swells, another ship had 33 ft. The storm started weakening on the

Figure 42.--The loose logs can be seen on the deck of the DRAGON III as it lists to port. Wide World Photo.

26th; the winds died down, but some swell waves of 20 to 30 ft still existed. The LOW disintegrated on the 27th.

There were plenty of ship reports to identify this frontal wave off Tokyo on the 26th. The storm moved slowly until the 29th, when it raced northeastward. During that period there were a few gales and 20-ft waves. The storm slowed and deepened on the 30th, and it was 954 mb near Kodiak at 1200. Ships in the Gulf of Alaska found winds as high as 55 kn and waves to 26 ft. On December 1 there were 45- to 55-kn winds and 30-ft waves. The GREAT LAND (57°N, 145°W) measured 52-kn winds with 42-ft waves. The LOW moved on the Alaska shore at 1200 and into the Arctic Ocean on the 3d.

The last storm of the month. It came off the Kurile Islands on the 28th. By the 29th there were gale and storm-force winds. The RATNA NANDINI (47°N, 166°E) found 58-kn winds and 43-ft waves, while the PRESIDENT TYLER (50°N, 160°E) estimated the winds at 45 kn and the waves at 39 ft. The PRESIDENT TYLER reported the winds as 65 kn and the seas 41 ft and swells 59 ft at 0000 on the 30th. The PANGUEON reported 50 kn with 41-ft swells. The storm was stationary near 51°N, 165°E at a lowest pressure of 968 mb. On the 1st the PRESIDENT TYLER (45°N, 161°E) was still finding 60-kn winds, 25-ft seas, and 59-ft swells, at 0000 and 0300 Z. By the 2d the winds and waves calmed as the storm fell apart.

Casualties--The following ships, listed in no particular order, suffered heavy weather damage this month: FUHWO VENTURE, OCEAN ENDURANCE, SUMMIT, ASSIMINA, CORAMONT, NEW ARROW, PRESIDENT MCKINLEY, WELL DESPATCHER, PACIFIC DESPATCHER, WILLIAMSBURGH, ASIA ANVIL, UNITED VENTURE, DEL CARMEN, PANAMERICA, KRITI PEARL, AEGEAN SUN, MOTILAL NEHRU, RODOSI. Others with weather problems were the EASTERN WISEMAN and RATNA NANDINI. The ADHIGUNA MERANTI grounded north of Keelung breakwater on the 15th. Rough seas Prevented vessels going along side until the 18th, when the crew was rescued by the Navy.

The following ships sank in heavy weather. The SHOKAI MARU (5,855 tons) sank off Hokkaido. The 17 crew members abandoned ship in a rubber boat, which capsized twice with only two survivors. The DRAGON III (fig. 42) capsized after listing 45° when stowage of logs collapsed near 38°N, 139°E. All the crew was rescued.

Other Casualties--The MANILA ENTERPRISE encountered force 11 winds on voyage to Bunbury. The STAR CAPELLA and IRON SOMERSBY had damage at Australia. The EMERALD sank off Qatar with nine crew members lost. The WOO JUNG No. 5 and WORLD STAR No. 6 had heavy weather problems at Karachi. The ZAIN BERBERA, with a cargo of cattle and sheep, developed a list in rough seas off Jeddah. The vessel was towed to port with low loss of animals.

WEATHER LOG, DECEMBER 1981--Compared with the Atlantic, the Pacific was just that this month. There appeared to be the usual number of cyclones, some large and deep, but they were not as vicious as in the North Atlantic. There were three primary storm paths; one from La Perouse Strait to and along the east coast of Kamchatka, another from off Hokkaido to the Fox Islands, and the last from midocean eastward along latitude 42°N to longitude 135°W, where it curved northeastward to Dixon Entrance. The last two paths differed from climatology in that they initially traveled eastward rather than northeastward, then curved eastward to southeastward.

The mean sea-level pressure pattern matched climatology better than the storm tracks. The Aleutian Low had two centers, 999 and 1001 mb, in an elongated LOW centered near latitude 55°N between longitudes 150°W and 170°E. These were within 1 mb of climatology. The Pacific High was normally centered near 30°N, 130°W at 1023 mb, 3 mb higher than climatology (fig. 43).

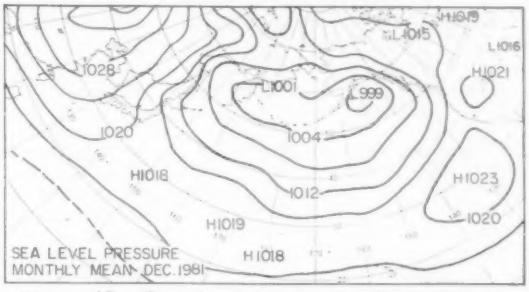


Figure 43.--December mean sea-level pressure.

The resulting anomaly centers were weak and diffuse over this ocean. There was an anomalous LOW over the Arctic-Siberian coast that produced a minus 15 mb anomaly center.

The upper-air pattern was near normal over the main shipping routes, basically zonal flow. The LOW center was shifted northwestward in response to the surface LOW over the Laptev Sea.

There were two typhoons, Lee and Kit. See Hurricane Alley.

Extratropical Cyclones--This storm formed off Tokyo on the 1st in an inverted trough. On the 2d the circulation had developed enough for storm force winds in the northerly circulation. At 0000 on the 3d the LOW was 976 mb near 42°N, 164°E. The CHIBA west of the center had 55-kn winds out of the north with 41-ft seas and 46-ft swells. The EASTERN ACE north of the center also had 55 kn at 090° with 26-ft waves. The 4th found a SHIP (42°N, 178°W) with 50-kn west winds and 21-ft waves, while another 500 mi to the southwest had 30-ft waves.

On the 4th the LOW was caught in the westerly zonal flow and raced eastward along 45°N. It weakened as it moved south of a LOW in the Gulf of Alaska and north of the associated front. There were some 20- to 25-ft waves east of this LOW along the front in the persistent westerly winds.

A ship, the JQOF, had 50-kn northwest winds with 26-ft waves southwest of the LOW on the 6th. The center moved ashore on the 7th over Cape Flattery.

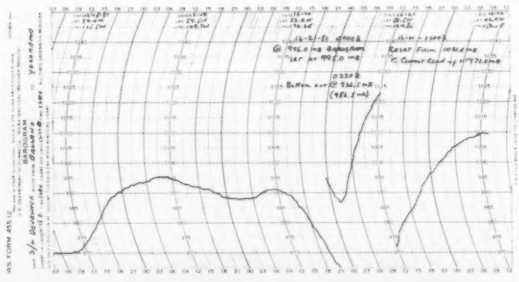
The cyclogenic area off Tokyo also produced this LOW on the 7th. By 0000 on the 9th the 982-mb LOW was near 41°N, 163°E. The OCEAN VENUS was 3 mb northwest of the center with 50-kn winds. The central pressure dropped 14 mb in the next 12 hr, and there were several storm wind reports. A ship at 38°N, 164°E found 33-ft waves.

On the 11th another LOW raced eastward into the circulation and became the primary center on the 12th. There were gales and 23-ft seas in the southwest quadrant. This LOW consolidated the circulation which extended from the North American west coast to 170°E and the Bering Strait to 30°N. At 0000 on the 13th the SPRAY STAN (39°N, 176°W) reported 87-kn winds which seemed high but she also reported 39-ft seas and 59-ft swells. The H9ZO called her wind at 58 kn. On the 14th the SPRAY STAN (41°N, 169°W), still in the southwest quadrant, reported 58-kn winds with 33-ft seas, and 59-ft swells. A small subcenter had formed off Washington, and the EXXON NEW ORLEANS (48°N, 132°W) found 70-kn winds, while another ship nearby found 55 kn. The LOW rapidly broke down late on the 14th as another moved into the southern periphery.

A front extended southeastward out of a LOW over the Kurile Islands. Late on the 13th a LOW developed at the point of occlusion. The AMERICAN LEGION suffered hatch cover and lashing wire damage about 1200 while about 270 mi east of Tokyo Bay, either with this storm or its parent. The LOW moved eastward and was 978-mb near 41°N, 168°W by the 15th. The YOUNG SPLENDOUR south of the center had 50-kn winds, and the YAMASHIN MARU (38°N, 175°W) had 21-ft waves. Late in the day there was a major shift of the center northward as the surface LOW lined up with the upper air. On the 16th the GLACIER BAY, 800 mi south of the center had 50-kn winds and 20-ft waves. The storm became stationary later in the day near 54°N, 153°W and at 0000 on the 17th was 944 mb. The highest wind was 50 kn in the southerly flow, where waves up to 23 ft were recorded. The PORTLAND reported 33 ft at 1800. On the 18th the original LOW was weakening, but a strong gradient persisted along the coast (fig. 44). The FORTUNSTAR (47°N, 127°W) called the wind 70 kn at 0000 on the 18th. The LOW disappeared on the 20th.

This storm was a small fish in a big pond but caused big waves. On the 18th the ocean between latitudes 25° and 75°N and Japan to the West Coast was covered by a large cyclonic circulation except for a ridge eastward from Tokyo. There were many low centers within this giant cyclone. One of these was a weak frontal wave east of San Francisco. It traveled northeastward. On the 19th the SPRAY STAN had made it to off Vancouver Island and now had 62-kn winds. The swell waves were 46 ft. Other ships were finding strong gales to storm-force winds, with waves over 25 ft. The storm moved ashore on the 20th and was gone.

Figure 44.--The original storm is near 55°N, 143°W, and a frontal wave is near 48°N, 133°W.



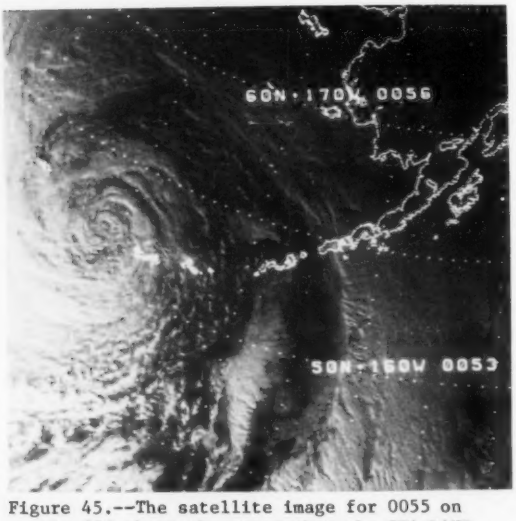


Figure 45.--The satellite image for 0055 on the 22d shows the storm that the SEA-LAND DEVELOPER sailed through about 22 hr earlier with 936-mb pressure on the barograph.

There was a col over the Sea of Japan on the 19th, and a low center formed. A 1052-mb Siberian High was pumping cold air southward, and the storm developed rapidly over the warm water.

By 0000 on the 21st the LOW had plunged to 936 mb, 52 mb in 24 hr. There were two reports over 60 kn; one was by the STAR ENTERPRISE (50°N, 162°E) with 49-ft waves. The other ship had 43-ft waves. The SEA-LAND DEVELOPER (52°N, 169°E) had easterly 58-kn winds with a 949-mb pressure and 33-ft seas (fig. 45). The storm reached 928 mb at 1200. There were many reports of winds over 50 kn on the 22d. The PRESIDENT TAFT had 33-ft swells. On the 23d the LOW was filling, weakening the gradient with slackening winds. Waves over 20 ft continued south of the center. The storm moved over the Gulf of Alaska on the 25th, causing no known trouble, then southeastward down the coast, and crossed inland near Seattle on the 28th.

There was frontogenesis over the Sea of Japan and Sea of Okhotsk on the 22d, and this wave was analyzed on the first chart of the 23d over the La Perouse Strait. Its circulation spread rapidly, but the gradient required for strong winds did not develop until late on the 24th. By 0000 on the 25th it was 970 mb near 54°N, 155°E. There were several reports near 50 kn with waves of 33 ft by two ships near 48°N, 157°E and 159°E. Others farther south had 20 to 25 ft. At 0600, three Japanese ships, the ALASKA MARU, SHINKO MARU, and ZENKO MARU, were between 47° and 50°N, and 157° and 159°E with winds of 50 to 60 kn and waves of 33 to 39 ft. The easternmost part of the front had crossed the Date Line and several ships found strong gales and high waves. The storm turned counterclockwise to the south and could not be found on the 27th.

As the upper-air LOW from the previous storm moved northward a cutoff LOW formed in the weakened trough. This built to the surface, and a frontal wave was identified on the 27th with ship reports and Midway Island. The RUDESHEIM reported 64-kn winds on the 28th about 150 mi southwest of the LOW center. Waves around the LOW exceeded 20 ft. At 1200 on the 29th the TOYOTA MARU No. 16 found 60-kn winds about 150 mi south of the 973-mb LOW, which was near 34°N, 175°W. The waves were 20 ft. Her winds were 50 kn at 0000 on the 30th about 400 mi to the southwest. The storm was moving northeastward between elements of the Pacific High.

High pressure to the north was blocking movement of the LOW and it was weakening. On January 1, 1982, it was drifting eastward and dissipated on the 3d.

Casualties--Although the North Pacific was quiet compared with the North Atlantic, there were a large number of weather-related casualties. The log carrier CRYSTAL STAR listed 30° in Luzon Strait, and 20 crewmen abandoned ship, with one missing. The following ships had weather damage: DELTA VENTURE, FUN JAY, GEMLOCK, HANJIN SEOUL, KAPTI, LARRY L. MAASKROON, MANILA MARINER, NANKI MARU, NASEEM, PSILI, SHORYU MARU, SING YONG, STAR ENTERPRISE, STRATEGIST, THETIS, VISAYAS, YUSEI MARU No. 12.

Other Casualties--The OCEAN VENTURE and ST. JOHN were at South Africa with weather damage. The IRON ENDEAVOUR arrived Newcastle with damage.

The research vessel GOTLAND II sank after being crushed by pack ice in the Yule Sea off Victoria-land, Antarctica. All personnel were safely evacuated by helicopters carried on board.

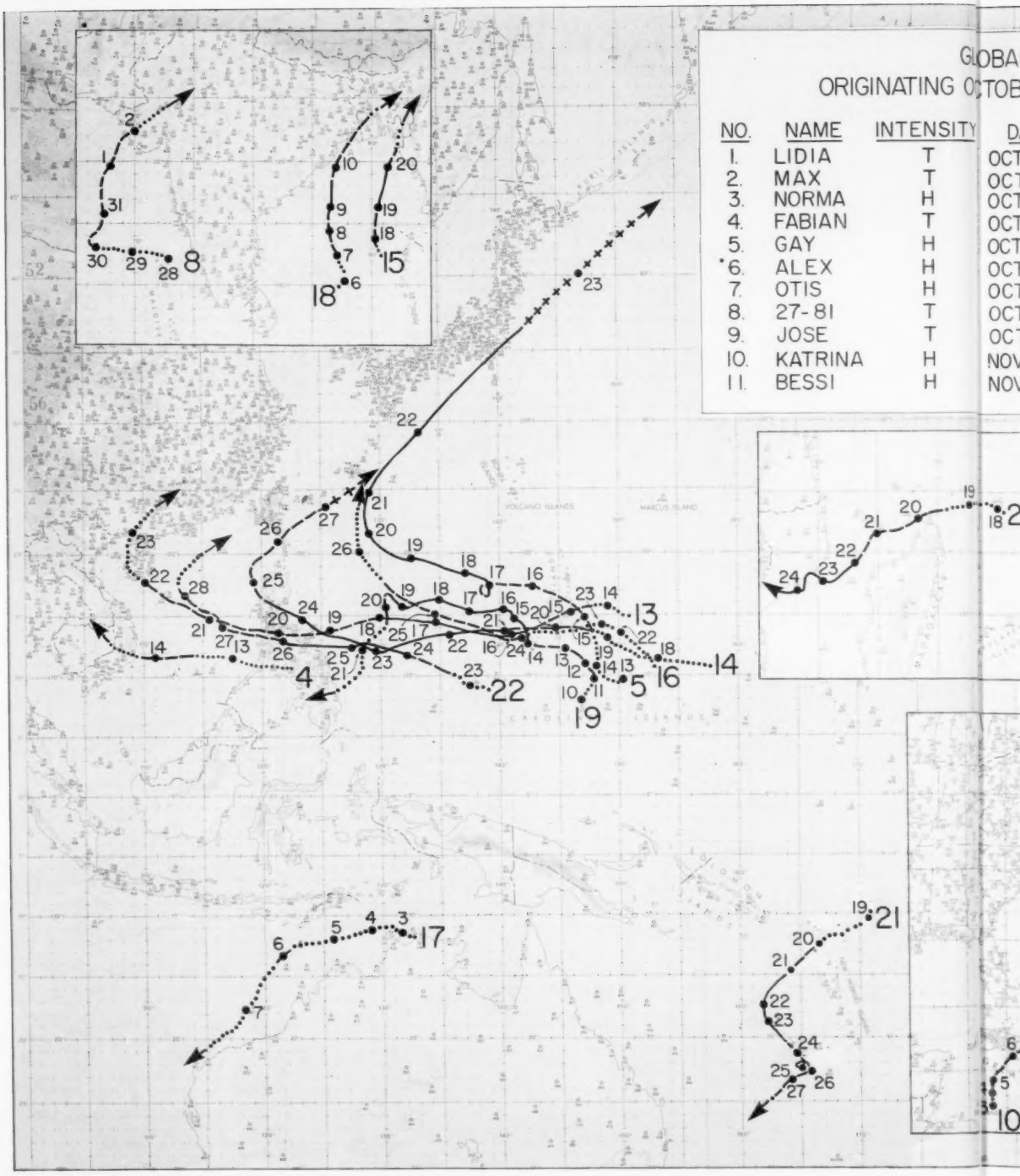
Hurricane Alley

October, November and December 1981

Dick DeAngelis
Environmental Data and Information Service, NOAA
Washington, D.C.

TROPICAL CYCLONES - OCTOBER 1981

Of the nine tropical cyclones that developed during this month, eight formed in the Northern Hemisphere (table 12). Early in the month short-lived eastern North Pacific storms Lidia, Max, and Norma came to life within 3 days of each other (fig.46). Only Norma reached hurricane strength before moving inland just north of Mazatlan with winds of 86 kn. Norma dumped torrential rains over a sparsely populated region in the state of Sinaloa causing serious flooding in the towns of Dimas, Coyotitan, La Cruz, and Piaxtla. At Piaxtla the Piaxtla River knocked out a bridge on Mexico's west coast highway and backed up trucks for miles. A few days earlier Lidia's rain had created problems farther north. She was responsible for 46 deaths and left 40 thousand people homeless. Torrential rains resulted in flash flooding over northern Sinaloa and hundreds of towns were swamped, crops destroyed and cattle swept away. Six large boats and 20 small launches were reported to have sunk in Topolobampo Bay. (Eastern Pacific tropical cyclones are summarized on page 59 of this issue.) Tropical storm Fabian and typhoon Gay popped up in the western North Pacific in midmonth. Gay reached maximum intensity on the 20th (fig. 47) when winds climbed to 95 kn around her 947-mb center. As she brushed the Ryukyus, Gay dumped 5.89 in of much needed rain on Okinawa, which had been in the throes of a severe drought. The JANUS I grounded about 300 mi off Nago Bay, Okinawa. As Gay passed the Boso Peninsula, within 30 mi of Tokyo, her rains triggered landslides and flooding; three people were killed in landslides and more than 38 thousand homes were flooded. Yokosuka Naval Facility reported 60-kn gusts and 9.38 in of rain. Late in the month Alex developed in the south Pacific, Otis in the eastern North Pacific and Jose in the


GLOBA
ORIGINATING OCTOB
NO. NAME INTENSITY D
1. LIDIA T OCT
2. MAX T OCT
3. NORMA H OCT
4. FABIAN T OCT
5. GAY H OCT
6. ALEX H OCT
7. OTIS H OCT
8. 27-81 T OCT
9. JOSE T OCT
10. KATRINA H NOV
11. BESSI H NOV

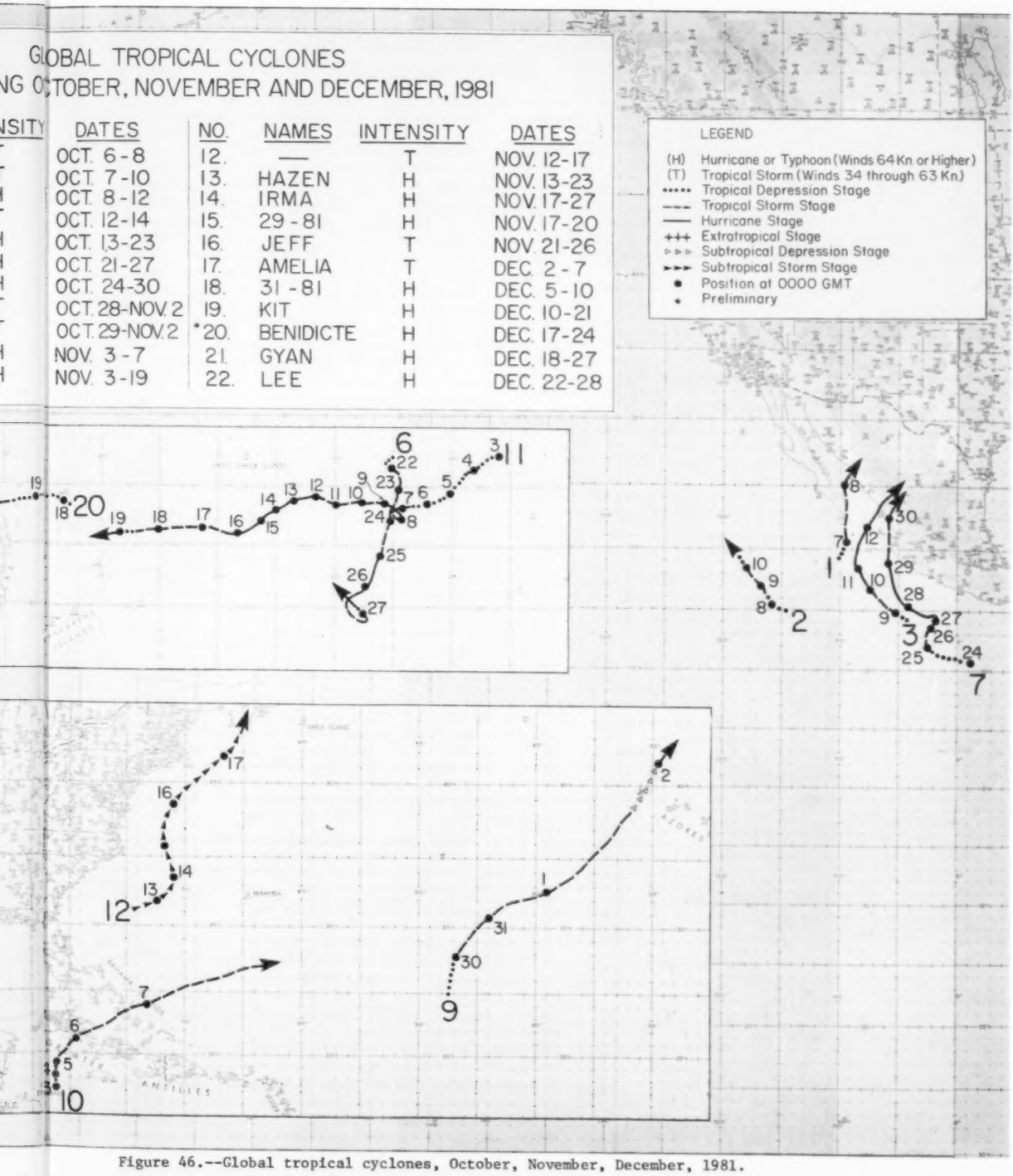


Figure 46.--Global tropical cyclones, October, November, December, 1981.

Table 12.--Global tropical cyclone summary, October, November, and December 1981

No.	Name	Est. Max. wind (kn)	Basin	Dates
		October 1981		
1.	Lidia	45	E. North Pacific	6-8
2.	Max	45	E. North Pacific	7-10
3.	Norma	110	E. North Pacific	8-12
4.	Fabian	45	W. North Pacific	12-14
5.	Gay	95	W. North Pacific	13-23
6.	Alex	75	South Indian	21-27
7.	Otis	75	E. North Pacific	24-30
8.	27-81	60	North Indian	28-Nov. 2
9.	Jose	45	North Atlantic	29-Nov. 2
		November 1981		
1.	Katrina	75	North Atlantic	3-7
2.	Bessi	90	South Indian	3-19
3.	-	60	North Atlantic	12-17
4.	Hazen	100	W. North Pacific	13-23
5.	Irma	135	W. North Pacific	17-27
6.	29-81	75	North Indian	17-20
7.	Jeff	35	W. North Pacific	21-26
		December 1981		
1.	Amelia	35	Aust.-S. Pacific	2-7
2.	31-81	70	North Indian	5-10
3.	Kit	115	W. North Pacific	10-21
4.	Benidicte	100	South Indian	17-24
5.	Gyan	105	Aust.-S. Pacific	18-27
6.	Lee	95	W. North Pacific	22-28

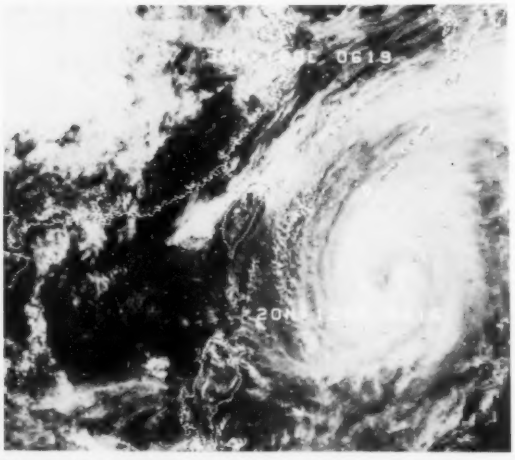


Figure 47.--Rainfall over Okinawa brought relief to the water-rationed population courtesy typoon Gay shown here on the 20th.

North Atlantic. Otis and Alex both reached hurricane intensity. In the North Indian Ocean a tropical storm (27-81) developed on the 28th. This Arabian Sea tropical cyclone whipped up 60-kn winds and 10-ft seas that played havoc with a large Indian fishing fleet. About a dozen of the 200 vessels were still missing after an intensive search. The SAFETY UNION, at Bombay, reported heavy weather damage as did several LASH barges from the ROBERT E. LEE. The death toll from the storms was estimated at 12. Damage was heaviest over the Saurashtra Peninsula.

TROPICAL CYCLONES - NOVEMBER 1981

Seven tropical cyclones developed over the world's oceans in November, all but one in the Northern Hemisphere. While Katrina was coming to life in the North Atlantic, Bessi was developing in the South Indian Ocean. According to Stephen Blumel: "The intensification of Hurricane Katrina to a minimal central pressure of 28.94 in (980 mb) and maximum sustained surface winds of 86 mph (75 kn) on November 5 places Katrina into a rare category of intensity for November hurricanes.... For the period 1900 through 1981, only six other November hurricanes have been observed with central pressure of less than 29.00 in. Katrina also was the most intense November hurricane to form in the Northwestern Caribbean Sea since the hurricane of November 1912...." The SEATTLE passed through the eye of Katrina early on the 5th (fig. 48). Bessi meanwhile developed winds of 90 kn by the 14th.

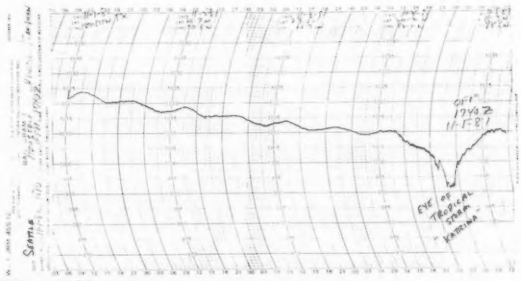


Figure 48.--Hurricane Katrina left her signature on the barogram of the SEATTLE on the 4th.

A string of two typhoons Hazen and Irma along with a tropical storm--Jeff, developed within a little more than a week in midmonth. Irma was the big one, reaching supertyphoon strength as winds climbed to 135 kn on the 22d; minimum pressure dropped to 902 mb. Although she weakened before making landfall 60 mi northeast of Manila, Irma still caused widespread destruction, including more than 400 deaths, with damage estimates of $9 million. Four coastal towns in the province of Camarines Sur were destroyed by 50-ft storm surge waves. Several ships ran aground near Manila including the COBALT, CARLO, and RITA RICH. The REYNA FILIPINA capsized outside Manila Bay. A few days earlier the VIRGINIA broke adrift and grounded during typhoon Hazen near the Santa Cruz Lighthouse, Marinduque Island. The FENTRESS, an American cargo vessel built in 1972, encountered gusts of more than 60 kn in Hazen and was driven aground near Saipan Island. The North Atlantic spawned a subtropical cyclone while a hurricane developed over the Bay of Bengal around midmonth. Winds in this cyclone reached 75 kn before she ran aground near Chittagong, Bangladesh on the 20th.

TROPICAL CYCLONES - DECEMBER 1981

Six tropical cyclones came to life this month with activity split evenly between hemispheres.

Amelia, a weak tropical storm, started things off in the Timor Sea on the 2d. Then a tropical cyclone developed in the Bay of Bengal on the 5th. Heading northward it reached hurricane intensity by the 8th. Ahead of it, the storm pushed storm tides along the Orissa coast. The storm hit just east of Bhubaneswar. It claimed 53 lives in West Bengal and 3 in Orissa. In Bangladesh there was a trail of destruction to shanty houses and standing crops. Typhoons Kit and Lee roamed the western North Pacific this month. Lee became another Philippine typhoon when he ripped across Luzon on the 24th. More than 100 thousand people were forced to leave their homes when Lee, sporting 90-kn winds, appeared over the Christmas weekend. Northern Samar Island and the smaller islands of Masbate, the Romblon group and Mindoro were the worst hit. An estimated 137 deaths were attributable to Lee. Kit generated maximum winds of 115 kn but nearly dissipated before reaching Mindanao. After midmonth two strong hurricanes--Gyan and Benidicte developed in the southern oceans. Benidicte, whose maximum winds were estimated at 100 kn, roamed South Indian seas while Gyan sporting 105-kn winds played among the New Hebrides.

The following excerpt is from a preliminary report prepared by M.L. Browne, Chief Meteorologist of the Nadi Weather Forecasting Centre, Fiji Meteorological Service:

"Tropical cyclone Gyan, which brought flooding to New Caledonia over the Christmas period, developed on the 19th about 500 mi west of Funafuti and 450 mi north-northeast of Espiritu Santo in the Vanuatu. The cyclone had its origins in a broad belt of cumulonimbus activity with cirrus outflow, reported by Honolulu on the 18th. By next morning two strong clusters were in evidence. During the next 3 days the system moved steadily southwestward at about 10 kn steadily increasing in intensity. By the 21st it was centered about 200 mi west of Santo and had increased to hurricane intensity with an eye visible on the satellite picture (fig. 49). During the 22d and 23d the cyclone began to recurve towards the south and later the southeast, moving over central New Caledonia on the 24th. The southeastward movement continued and by midday on the 25th, when communications with New Caledonia were restored after a break of 24 hr, the cyclone was centered not far to the southeast of Noumea. At this stage it appears to have become quasi-stationary for a time and then began to move very slowly towards the west and later the southwest, losing intensity as it did so. By the 28th it had become shallow and difficult to locate, having lost all its tropical cyclone characteristics.

"Although there is little doubt that Gyan attained hurricane intensity, the strongest winds reported from any synoptic station or ship were 50 kn. However, it must be borne in mind that communications were lost with New Caledonia for 24 hr after the cyclone reached that island. The satellite imagery analysts in Washington gave the cyclone its maximum current intensity of 5.0 on the Dvorak scale on the 21st at 1800, corresponding to maximum average windspeeds

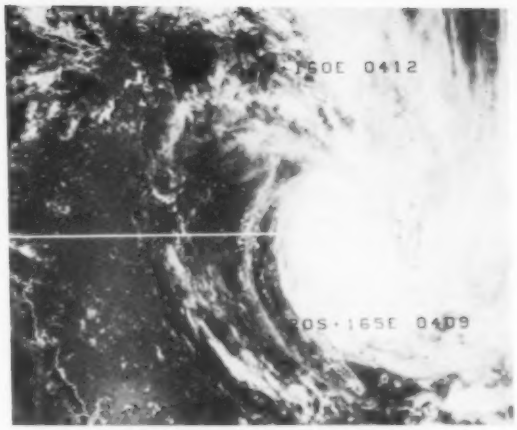


Figure 49.-- Gyan and her clockwise circulation approaches New Caledonia.

(10 minute period) of 80 kn. The estimates of hurricane intensity were maintained from the 22d to the 24th. On the 26th the cyclone was still producing gales. At 1800 on the 25th a ship reported 40 kn at a distance of 120 mi from the center."

Mr. Ravard, chief of New Caledonia's meteorological service, reports that Gyan was the first December tropical cyclone to affect the islands since 1951. Gyan's winds were strongest in the north, particularly in exposed valleys. At Koumac maximum wind speeds climbed to 92 kn from the north. Torrential rains brought welcome relief from a drought; 28.9 in fell at Yate on the east coast. Two people drowned and one was electrocated during the storm.

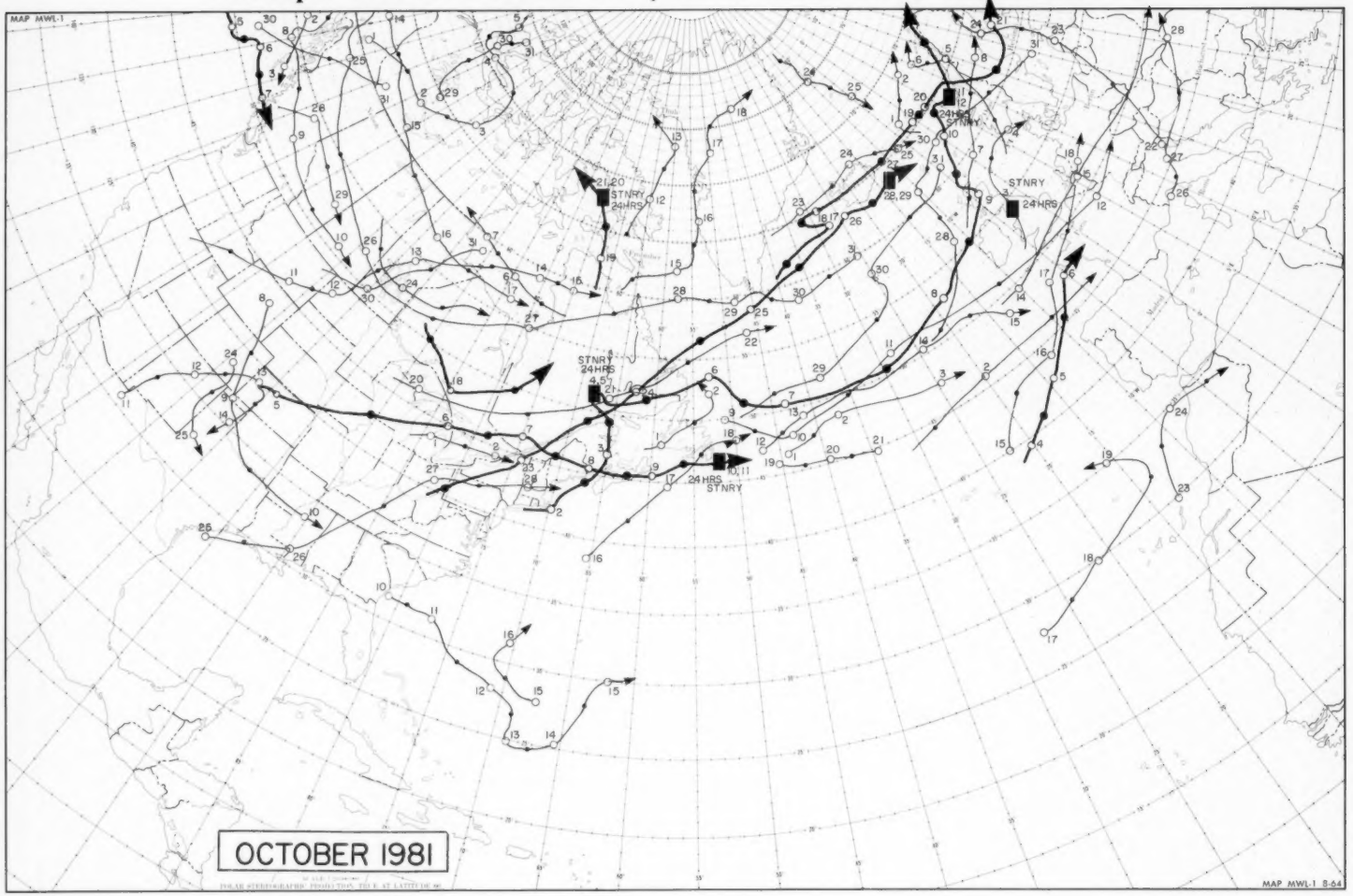
TROPICAL CYCLONE WATCH--1982

Table 13 is a preliminary list of the global tropical cyclones that have occurred up until press time.

Table 13.--World tropical cyclone watch, 1982

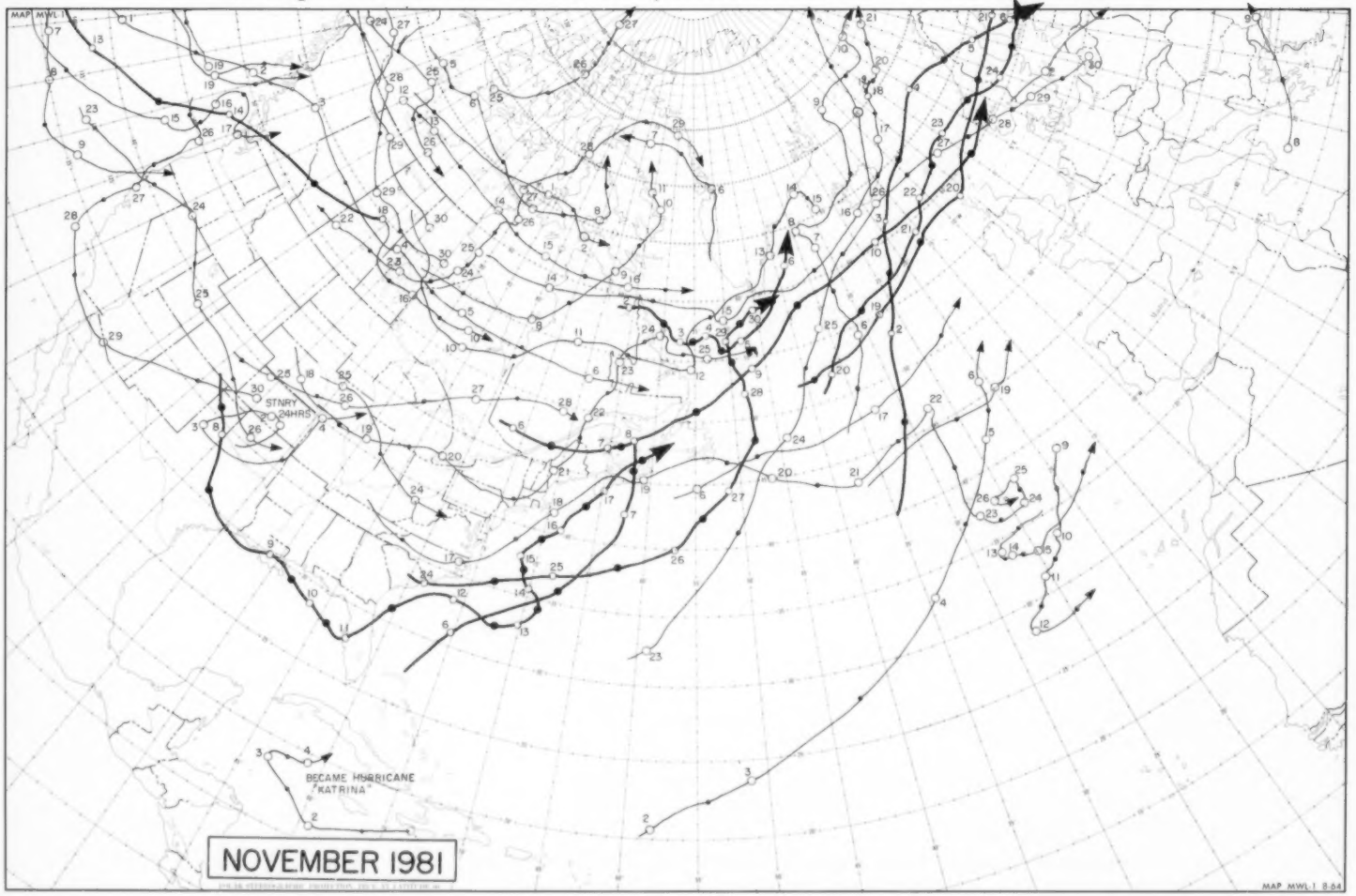
Western North Pacific				Australia-South Pacific			
Mamie	TC-1	T	March	Bruno	5-82	T	Jan.
Nelson	TC-2	H	March	--	6-82	T	Jan.
Odessa	TC-3	H	March	Hettie	7-82	H	Jan.
				Abigail	8-82	H	Jan.
North Indian Ocean				Graham	9-82	T	Feb.
--	20-82	H	May	Harriet	11-82	T	Feb.
				Ian	13-82	H	Feb.
South Indian Ocean				Isaac	14-82	H	March
--	1-82	T	Jan.	Bernie	17-82	H	April
Chris	2-82	H	Jan.	Dominic	18-82	T	April
Daphne	3-82	T	Jan.				
Errol	4-82	T	Jan.				
Electra	10-82	T	Feb.				
--	12-82	T	Feb.				
Justine	15-82	H	March				
--	16-82	T	March				
Karla	19-82	H	April				

Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic



Closed circle indicates 0000 and open circle 1200 GMT positions. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Weather Log.

Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic



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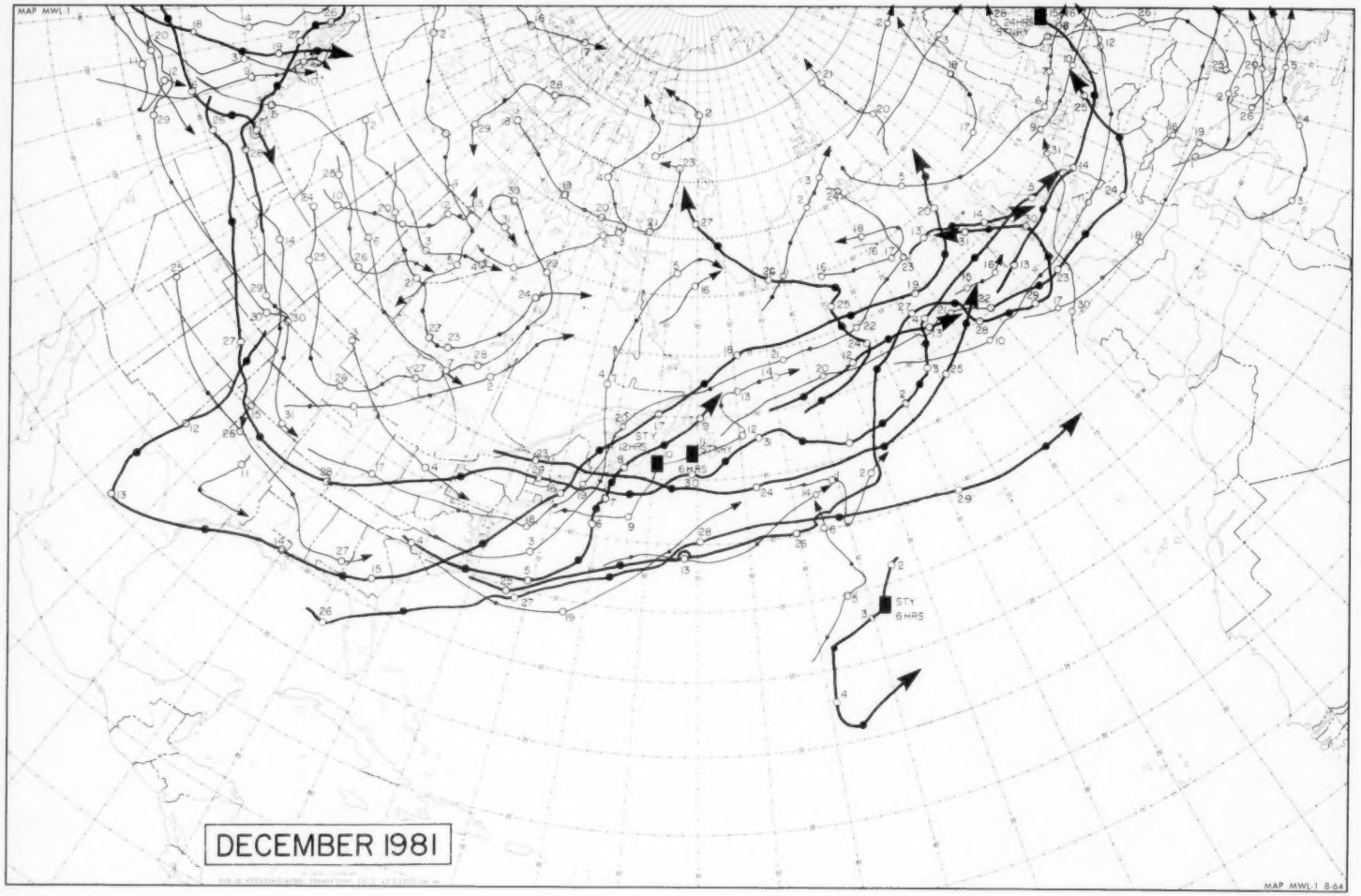
Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic



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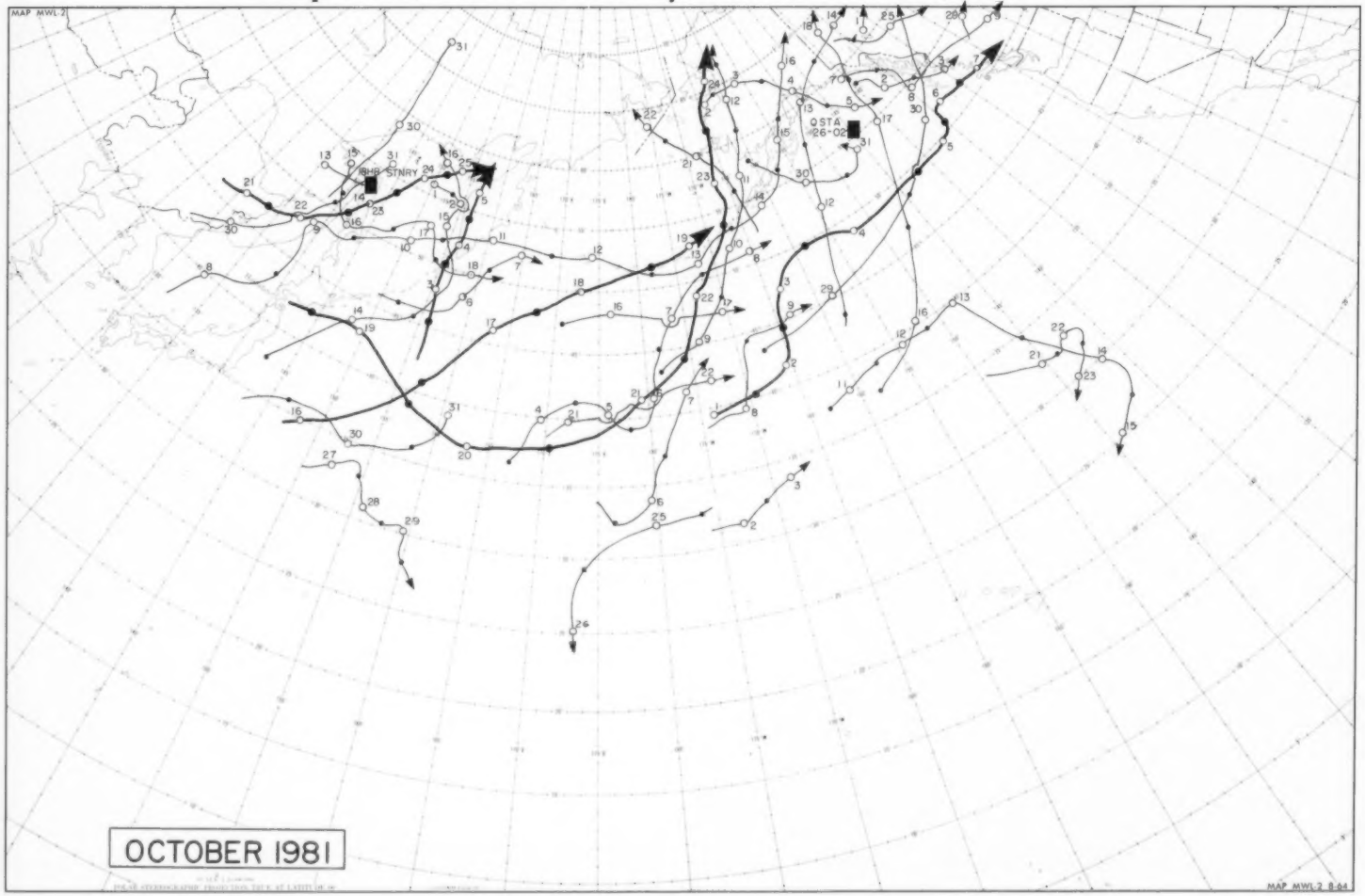
Principal Tracks of Centers of Cyclones at Sea Level, North Pacific



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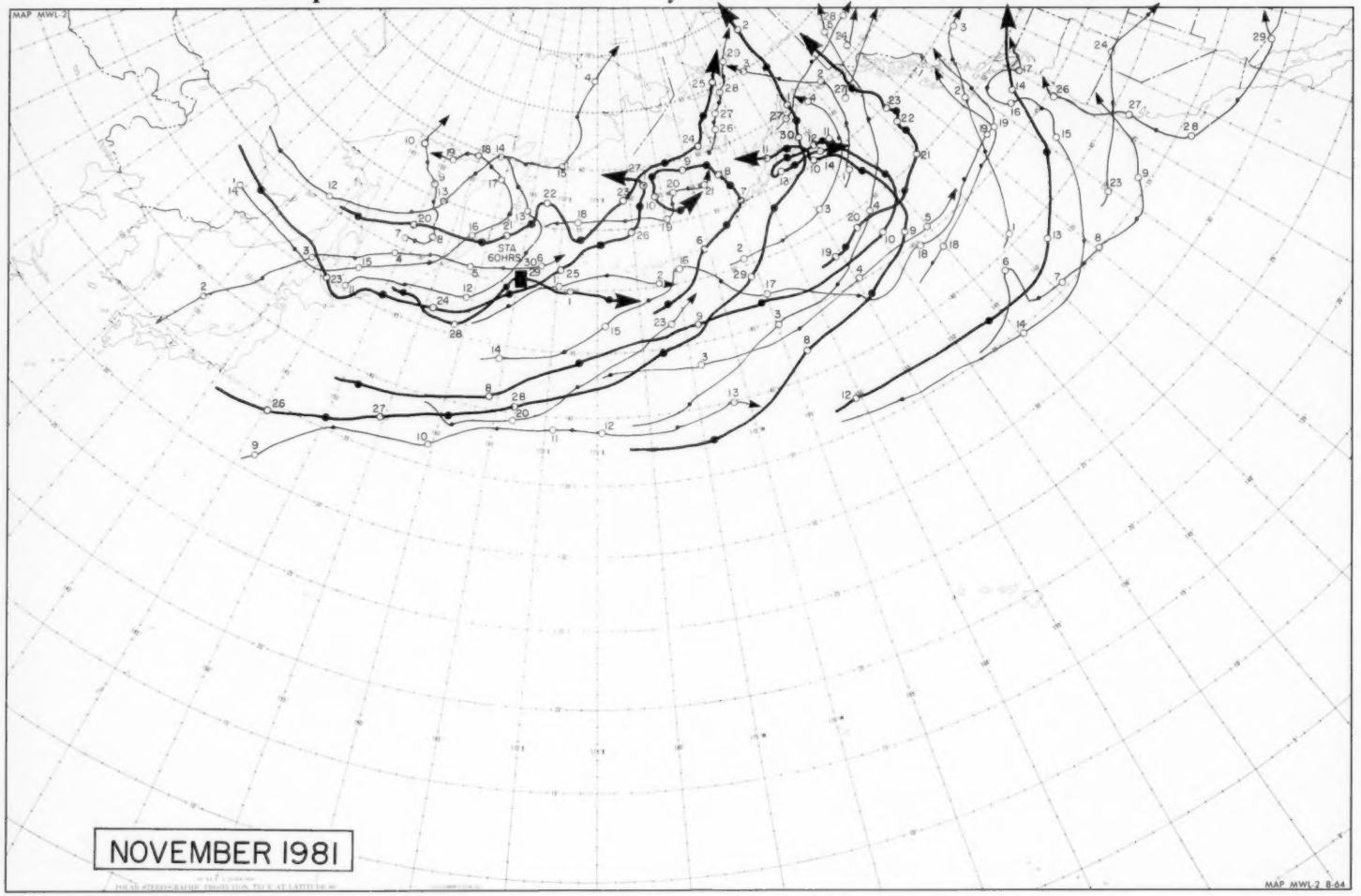
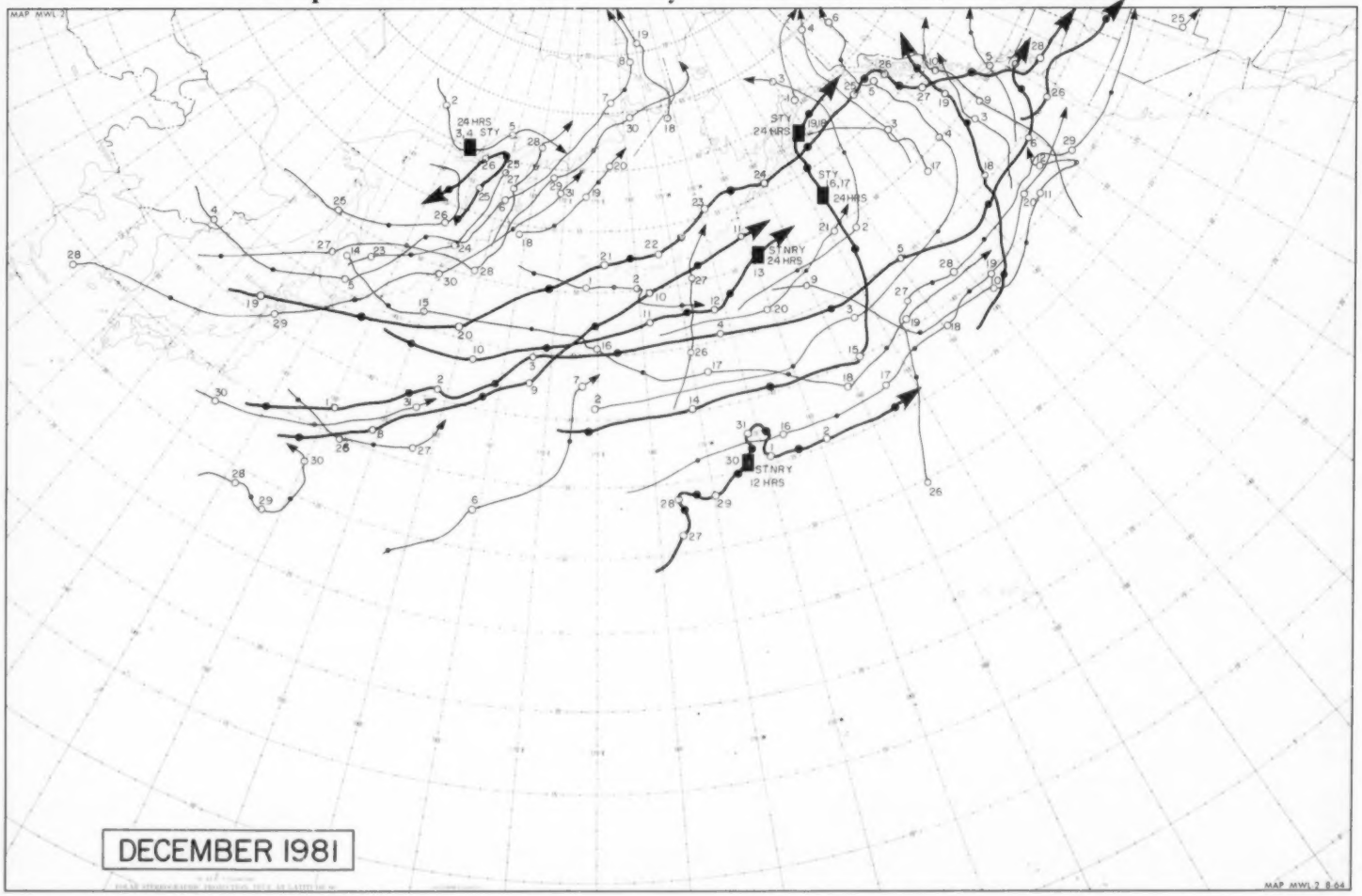
Principal Tracks of Centers of Cyclones at Sea Level, North Pacific



positions

Closed circle indicates 0000 and open circle 1200 GMT poistions. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Weather Log.

Principal Tracks of Centers of Cyclones at Sea Level, North Pacific



Closed circle indicates 0000 and open circle 1200 GMT positions. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Weather Log.

North Atlantic Selected Gale and Wave Observations

October, November and December 1981

Vessel	Nationality	Date	Position of Ship		Time GMT	Wind		Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C		Sea Waves*		Swell Waves		
			Lat. deg.	Long. deg.		Dir. 10°	Speed kt.				Air	Sea	Period sec.	Height ft.	Dir. 10°	Period sec.*	Height ft.
NORTH ATLANTIC OCEAN		OCT.															
EXPORT COMMERCE	WGKC	3	36.2 N	58.4 W	18	16	45	5 NM	07	1010.9	24.4	24.4	3	8	16	6	14.5
DALLAS MEC 716	NPCR	6	42.9 N	59.9 W	00	33	NW 52	5 NM	07	0998.0	21.1	13.9	4	5			
AMERICAN LEGEND	KFEY	6	49.5 N	74.5 W	06	23	45	5 NM	02	1000.0	14.0	14.7	6	8	05	< 6	10
T F L LIBERTY	9VDD	8	51.3 N	18.1 W	18	29	NW 51	5 NM	25	0990.5	13.0	14.5	XX		29	10	19.5
MECNTA	CKON	9	49.6 N	12.8 W	00	25	47	5 NM	16	1000.2	14.4		8	13	21	>13	19.5
AMERICAN LEGEND	KFEY	9	49.9 N	13.9 W	06	30	45	5 NM	81	1014.0	12.0	14.4	5	6.5	30	7	13
TAIWAN PHOENIX	9V8S	9	50.7 N	15.8 W	06	30	NW 45	5 NM	25	1007.8	11.8	18.0					
PERSEJOT	LCXZ	16	49.6 N	12.5 W	18	23	NW 50	5 NM	63	1020.4	14.5	12.4	9	6.5			
PERSEJOT	LCXZ	19	48.7 N	13.5 W	00	23	NW 50	10 NM	15	1022.4	16.2	14.6	XX	8			
DAUNTLESS CG	NDTS	23	19.8 N	86.7 W	06	09	NW 25	10 NM	02	1013.2	26.5	28.8	0	R2	40	6	R2
GREAT LAKES VESSELS																	
EDWARD L RYERSON	9878	1	43.2 N	87.1 W	06	26	NW 48	> 25 NM	02		13.0	13.0		10			
CHARLES M BEEGHLY	9856	1	42.4 N	87.5 W	12	26	NW 42	10 NM	02		8.0	14.0	4	6.5			
CHARLES M BEEGHLY	9856	2	45.6 N	86.5 W	06	35	NW 42	10 NM	02		1.0	10.0	5	8			
BENJAMIN F FAIRLESS	9803	7	44.8 N	83.1 W	00	30	NW 48	10 NM	02		6.0	11.0		8			
A H FERBERT	9801	7	46.2 N	84.9 W	00	32	NW 49	10 NM	02		6.0	14.0	7	5			
LEON FRASER	9827	7	44.9 N	83.1 W	12	31	NW 43	> 25 NM	02		3.0	10.0		6.5			
JOHN G MUNSON	9882	7	44.5 N	82.9 W	18	31	NW 48	10 NM	02		8.0	11.0		8			
IRVING S OLDS	9819	16	42.2 N	80.7 W	18	26	NW 56	> 25 NM	03		14.0	20.0	5	10			
J A L IGLEHART	9876	16	41.5 N	82.2 W	18	24	NW 48	10 NM	03		12.0	10.0	5	6.5			
J A L IGLEHART	9876	19	42.2 N	82.4 W	00	27	NW 48	10 NM	03		12.0		3	3			
IRVING S OLDS	9819	19	41.6 N	81.7 W	00	27	NW 42	5 NM	18		8.0	15.0	5	10			
JOHN G MUNSON	9882	19	45.6 N	83.8 W	00	30	NW 47	2 NM	69		1.0	8.0		14.5			
		NOV.															
HORTOLES CABRILHO	CSDU	1	33.1 N	56.4 W	00	02	50	2 NM	25	1014.0	19.0	25.0		23			
TFL DEMOCRACY	9VPN	1	43.6 N	49.3 W	12	31	NW 43	5 NM	02	1021.0	7.0	7.0	3	6.5	31	< 6	8
MORMACVEGA	WMBU	1	33.2 N	66.9 W	12	07	40	10 NM	01	1023.0	21.3	27.2	8	16.5	07	10	32.5
AMERICAN ACE	KFCV	1	42.6 N	69.5 W	12	33	45	10 NM	02	1021.5	6.9	14.4	5	14.5	33	6	19.5
ARGONAUT	KFDV	1	39.3 N	45.9 W	18	34	42	5 NM	25	1015.9	12.8	20.0	8	14.5	36	12	16.5
SEALAND GALLOWAY	KHLX	4	43.4 N	42.2 W	06	22	42	2 NM	02	0997.6	16.7	18.3	7	8	22	9	11.5
MEALOWBROOK	KIMS	7	22.5 N	74.5 W	00	30	48	10 NM	07	1005.8	26.7	28.3	4	16.5	25	7	14.5
RUYER	KEAO	8	40.1 N	55.9 W	00	16	41	2 NM	02	1003.0	21.7	22.8	7	10	18	12	21
TFL EXPRESS	9VPU	8	45.1 N	53.4 W	06	16	NW 45	5 NM	02	1001.0	14.0	12.0	3	5	17	< 6	10
NECHES	NOIS	12	30.7 N	76.8 W	00	35	38	5 NM	07	1013.0	17.7	23.9	6	19.5	36	12	36
BALTIMORE TRADER	KASJ	12	36.7 N	73.8 W	18	02	45	5 NM	01	1018.0	13.3	17.2	5	16.5	03	< 6	19.5
EXPORT FREEDOM	WEJS	13	36.8 N	75.2 W	00	02	48	10 NM	03	1011.5	10.0	14.5	10	19.5	02	12	19.5
AMERICAN LYNX	WZJL	13	34.0 N	75.2 W	12	02	45	5 NM	02	1017.0	14.4	24.4	6	16.5	01	7	23
EXPORT FREEDOM	WEJS	14	37.6 N	72.1 W	06	04	48	5 NM	02	1010.1	16.7	16.2	12	32.5	03	12	19.5
FLEANDER	PJYG	14	39.6 N	71.1 W	15	05	43	2 NM	25	0989.1	*						
TRANSCOLUMBIA	KPDL	14	54.9 N	16.9 W	18	20	45	5 NM	80	1005.8	10.6	10.6	5	14.5	20	6	18
TRANSCOLUMBIA	KPDL	15	55.1 N	16.4 W	00	24	45	5 NM	80	1003.4	11.2	10.0	5	11.5	20	6	18
FLEANDER	PJYG	15	34.7 N	70.2 W	00	21	45	2 NM	25	0992.0	21.0						
EXPORT FREEDOM	WEJS	15	36.2 N	71.2 W	00	05	50	1 NM	01	0999.1	12.0	18.4	15	29.5	05	>13	29.5
NEW JERSEY SUN	KEAL	15	37.2 N	74.3 W	01	01	45	5 NM	10	1005.0	17.2	16.8	5	19.5	02	>13	23
SEATTLE	KVKH	15	35.7 N	72.9 W	03	34	56	5 NM	62	0995.0	17.7	22.7	9	16	06	8	18
MARINITA	LURI	15	38.8 N	73.1 W	06	03	NW 42	2 NM	20	1000.0	12.0						
LAKE SHASTA	FMOL	15	37.3 N	72.0 W	18	31	45	1 NM	02	0987.0	16.7		6	13			
SEATTLE	KVKH	16	37.2 N	72.3 W	03	29	45	5 NM	21	0998.5	15.0	22.7	7	13	31	9	18
SEALAND ADVENTURER	KSLJ	16	40.6 N	67.3 W	21	20	45	2 NM	55	0989.6	14.0	20.0	9	16.5	20	>13	19.5
SEALAND ADVENTURER	KSLJ	17	40.6 N	67.9 W	00	27	50	5 NM	25	0990.3	12.5	20.0	9	13	27	9	23
VALOR	DZNP	18	36.7 N	64.7 W	12	23	NW 41	5 NM	03	0999.2	21.0	21.0	5	13	23	8	16.5
FLEANDER	PJYG	18	37.2 N	66.8 W	18	29	44	5 NM	25	0999.9	17.9	20.1	6	14.5	29	7	19.5
FLEANDER	PJYG	19	37.7 N	69.5 W	03	30	45	5 NM	02	1004.0	15.3						
VALOR	DZNP	19	38.1 N	66.7 W	12	28	NW 41	10 NM	02	1006.0	19.0	22.0	5	13	28	6	14.5
ALBA DEL MAR	EHBZ	19	39.3 N	64.7 W	12	29	45	10 NM	02	1002.0	15.2	16.0	5	5		< 6	5
NORSH ORRIS	LAMS	20	36.7 N	49.1 W	18	26	42	5 NM	60	1006.0	19.0	20.0	10	19.5	23	< 6	10
TFL FREEDOM	9VRX	21	46.9 N	49.0 W	13	01	NW 18	> 25 NM	00	1016.5	5.5	7.5	XX	5	04	10	32.5
MARCONA CONVEYOR	ELDU	25	36.1 N	74.5 W	00	33	NW 55	.25 NM	97	0999.0	9.0	21.2					
LEON FRASER	FMPG	25	37.7 N	70.8 W	12	02	NW 48	2 NM	62	0998.5	12.0	19.0	6	14.5	03	9	32.5
SANTA FE	LGGH	25	33.2 N	71.1 W	12	30	65	1 NM	61	1009.5	16.5	23.0	10	39			
MORMACSTAR	KGDF	25	31.2 N	70.7 W	12	31	42	10 NM	02	1004.1	17.8	22.2	9	13	30	9	13
FLEANDER	PJYG	25	36.0 N	69.1 W	18	32	60	2 NM	25	0994.0	15.0		10	39			
FLEANDER	PJYG	26	36.3 N	69.5 W	00	33	48	5 NM	25	1004.2	12.0	20.9					
LEON FRASER	FMPG	26	37.6 N	69.2 W	00	35	NW 41	2 NM	61	1004.5	11.5	23.0	6	14.5	03	9	29.5
TFL EXPRESS	9VPU	26	42.6 N	47.9 W	12	12	NW 54	1 NM	25	0997.5	15.5	15.5	7	16.5	11	9	19.5
AMERICAN ACCORD	KFEZ	26	45.2 N	58.4 W	18	01	55	2 NM	64	0998.5	5.0	7.7	XX	21	02		21
SEALAND VENTURE	KSJH	26	27.6 N	61.8 W	18	27	50	10 NM	02	1010.0	20.0	25.0	8	13	27	11	16.5
TFL EXPRESS	9VPU	27	44.4 N	40.4 W	12	16	NW 55	1 NM	07	0997.0	16.0	18.5	4	10	16	6	19.5
SEALAND PIONEER	WSVB	28	42.6 N	36.7 W	00	21	NW 45	2 NM	21	0998.5	17.5	17.0	4	8	21	6	14.5
AMERICAN ACE	KFCV	28	45.2 N	35.8 W	00	16	43	5 NM	02	1004.3	17.7	16.6	6	10	16	6	14.5
TFL EXPRESS	9VPU	28	45.9 N	71.7 W	12	16	NW 54	5 NM	02	1009.0	17.5	18.0	4	6	16	7	13
TFL EXPRESS	9VPU	29	46.5 N	27.1 W	00	16	NW 50	2 NM	02	1016.0	16.0	16.0					
CAPE WRIGHT	NPCA	29	32.4 N	57.0 W	09	22	NW 47	> 25 NM	03	1004.7	19.4	22.2	3	6.5	31	11	11.5
AMERICAN ACE	KFCV	29	42.6 N	45.7 W	18	19	56	2 NM	21	0998.3	16.4	20.0	6	13	19	7	18
GREAT LAKES VESSELS																	
JOHN DYKSTRA	9852	10	47.1 N	86.0 W	12	22	NW 45	5 NM	70		1.0	4.0		10			
A H FERBERT	9801	31	41.7 N	82.4 W	00	28	NW 42	2 NM	26		2.0	10.0	7	5			
ELTON HOYT II	9812	26	45.8 N	84.4 W	18	14	NW 43	10 NM	03		2.0	4.0	3	5			
JOHN G MUNSON	9882	27	46.1 N	82.6 W	18	27	NW 42	10 NM	02		9.0	7.0		6.5			
ENVIRONMENTAL BUOYS																	
41001		25	34.7N	072.3W	09	35	M52			996.7	12.9	21.7	5	19			

Vessel	Nationality	Date	Position of Ship		Time GMT	Wind		Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C		Sea Waves+		Swell Waves		
			Lat. deg.	Long. deg.		Dir. 10°	Speed kt.				Air	Sea	Period sec.	Height ft.	Dir. 10°	Period sec.*	Height ft.
NORTH ATLANTIC OCEAN		DEC.															
STAR DOVER	LEQY	2	46.1 N	30.6 W	12	16	45	2 NM	40	1022.0	17.0						
TRANSCOLUMBIA	KPGQ	2	43.1 N	32.8 W	12	20	45	5 NM	05	1018.6	17.3	17.7	5	10	20	7	18
EXPORT COMMERCE	WGKE	2	37.9 N	45.4 W	16	32	45	10 NM	07	1012.0	15.6	20.6	3	8	22	6	19.5
TRANSCOLUMBIA	KPGQ	3	43.6 N	36.9 W	00	17	45	10 NM	02	1015.9	17.8	16.7	5	10	17	7	16.5
TERRIER	LFEA	5	40.3 N	68.7 W	16	04	48	.25 NM	81	0999.5	7.0		12	19.5	04	12	19.5
NANTUCKET II	NNRN	5	40.5 N	69.5 W	21	09	M 45	.5 NM	65	0996.6	.		3	8	03	< 6	19.5
NANTUCKET II	NNRN	6	40.5 N	69.5 W	09	32	N 54	.5 NM	65	0987.5	.		3	8	32	7	19.5
TERRIER	LFEA	6	40.2 N	64.3 W	12	21	55	2 NM	02	0978.5	15.0						
TRANSCOLUMBIA	KPGQ	6	40.5 N	59.1 W	18	20	45	5 NM	62	0995.3	15.6	18.2	5	19.5	20	8	23
TRANSCOLUMBIA	KPGQ	7	40.4 N	60.0 W	00	20	50	5 NM	13	0992.9	14.0	18.2	5	19.5	20	8	23
NANTUCKET II	NNRN	7	40.5 N	69.5 W	00	31	M 45	.5 NM	23	0988.8	.		3	5	30	6	18
LASH PACIFICO	WIEE	7	38.4 N	66.3 W	01	29	40	2 NM	25	0993.6	5.0	21.1	8	29.5	29	10	34.5
SEALAND ECONOMY	WNDJ	7	36.8 N	69.9 W	06	32	42	5 NM	02	1005.1	10.6	23.3	6	11.5	32	8	11.5
IFL FREEDOM	9VXX	7	35.6 N	65.6 W	12	26	M 48	10 NM	50	1003.0	14.0	21.5	10	24.5			
RODRIGUES CARRILHO	CSDU	7	35.8 N	63.3 W	12	27	58	2 NM	64	1000.5	14.5	22.0	XX	32.5	XX		16.5
SEALAND PACER	KSLB	7	40.9 N	64.4 W	18	25	M 55	2 NM	07	0987.1	10.0	16.2	5	8	25	6	16.5
SEALAND PACER	KSLB	8	40.3 N	64.8 W	00	26	M 50	5 NM	02	0995.2	9.5	16.2	5	8	26	6	16.5
TRANSCOLUMBIA	KPGQ	8	40.2 N	63.0 W	00	27	60	5 NM	02	0995.3	10.0	19.4	8	23	27	>13	24.5
IFL FREEDOM	9VXX	8	36.6 N	61.7 W	00	28	M 45	10 NM	01	1004.5	16.0	21.5					
IFL DEMOCRACY	9VPR	8	38.6 N	68.0 W	00	29	M 44	5 NM	02	1003.0	12.5	16.0	4	11.5	29	7	14.5
IFL EXPRESS	9VPU	8	49.3 N	55.9 W	06	28	M 42	10 NM	02	0986.0	11.5	14.0					
PEONIA	OXON	8	48.7 N	07.5 W	12	29	43	10 NM	02	0992.2	11.8	12.0	6	19.5			
AMERICAN ACCORD	KFEZ	8	57.2 N	22.4 W	18	34	41	5 NM	02	1006.0	1.7	10.0					
AMERICAN ACE	KFCV	9	34.4 N	64.8 W	18	25	48	10 NM	03	1010.0	17.7	21.0	6	29.5	25	6	29.5
AMERICAN ACE	KFCV	10	34.7 N	62.5 W	00	25	45	10 NM	00	1008.2	16.7	21.2	5	26	30	8	29.5
JUTHLANDIA	ELXV	13	46.9 N	13.1 W	12	27	47	5 NM	80	0993.0	15.0	10.7	8	23	27	12	24.5
L.W. FUNKHOUSER	ABCZ	15	46.1 N	08.2 W	18	25	M 42	5 NM	60	1001.5	15.5	13.3	6	11.5	26	>13	11.5
OVERSEAS MARILYN	WFOB	16	48.1 N	09.9 W	11	28	M 48	5 NM	03	1015.0	12.0	14.0	4	8	28	7	19.5
NANTUCKET II	NNRN	16	40.5 N	69.5 W	12	22	M 45	2 NM	03	0991.5	12.8		1	3	20	< 6	10
DALLAS WMEC 716	NPCR	16	40.3 N	73.0 W	23	29	M 42	10 NM	02	1015.5	5.0	6.7	4	3			
AMERICAN ALLIANCE	KFEM	17	43.4 N	53.2 W	18	25	42	5 NM	02	1009.8	10.0	13.3	5	29.5	23	7	29.5
YUKON T-AO 152	NUOP	18	43.0 N	09.4 W	07	31	40	10 NM	25	1007.8	11.2	15.6	5	32.5			
AMERICAN ALLIANCE	KFEM	18	45.5 N	43.5 W	18	27	35	5 NM	02	1010.0	8.7	9.5	6	36			
AMERICAN ALLIANCE	KFEM	19	46.3 N	40.7 W	00	27	34	10 NM	02	1009.5	7.7	17.3	6	32.5			
AMERICAN ARGOSY	KFCX	19	48.7 N	21.9 W	18	29	42	5 NM	02	1005.1	9.5	11.7	7	16.5	29	6	16.5
AMERICAN RANGER	KNKW	19	48.6 N	13.3 W	18	24	45	10 NM	02	1009.5	14.4	10.0	9	23	XX		
AMERICAN RANGER	KNKW	22	40.3 N	70.3 W	06	25	50	10 NM	02	1013.5	17.8	15.6	5	13	XX		
EXPORT FREEDOM	WCJS	22	37.1 N	38.9 W	12	22	25	5 NM	16	1015.9	18.8	19.3	5	13	22	13	34.5
SEALAND ECONOMY	WNDJ	22	52.4 N	40.0 W	12	31	42	10 NM	03	0993.9	2.8	7.2	5	5	25	10	16
SEALAND PIONEER	WSVB	22	35.6 N	12.6 W	18	35	M 40	5 NM	02	1011.8	17.0	17.0	10	13	35	10	32.5
SEALAND EXPRESS	WCJD	23	47.4 N	15.3 W	06	23	M 46	10 NM	01	0989.4	10.0	15.0	5	10	XX		11.5
BARBER TAIF	LIPD	24	36.3 N	32.4 W	06	21	50	5 NM	03	1012.0	21.0	19.0					
CLARA MAERSK	OWIK	24	39.5 N	52.8 W	12	26	63	2 NM	00	1007.0	18.2	18.0					
AMERICAN LEADER	KFEJ	24	53.3 N	34.7 W	18	29	42	10 NM	24	0981.4	2.2	7.8	13	16.5	25	< 6	13
AMERICAN ACE	KFCV	24	49.1 N	23.5 W	18	24	55	2 NM	18	0999.3	12.8	13.3	4	11.5	25	6	16.5
CHARLES PIGOTT	SLPA	24	36.8 N	36.9 W	18	25	M 50	5 NM	62	1011.4	17.8	18.9	8	16.5			
AMERICAN RANGER	KNKW	25	37.0 N	52.0 W	00	25	45	5 NM	03	1013.0	20.0	17.7	7	19.5	XX		
CHARLES PIGOTT	SLPA	25	38.5 N	36.2 W	06	29	M 50	10 NM	03	1005.8	17.0	18.9	10	16.5			
SEALAND PIONEER	WSVB	25	35.0 N	36.1 W	12	29	M 30	5 NM	01	1012.0	19.0	19.0	10	8	29	12	32.5
SEALAND GALLOWAY	KHLX	25	49.2 N	24.0 W	12	34	45	2 NM	07	0971.5	12.3	11.2	6	16.5	20	11	26
AMERICAN ACE	KFCV	25	48.6 N	32.8 W	18	28	50	10 NM	03	0980.0	8.9	12.3	5	26	29	< 6	29.5
IFL FREEDOM	9VXX	25	50.1 N	39.0 W	18	31	M 49	10 NM	88	0985.5	7.0	14.0	12	29.5	30	13	26
OGDEN FRASER	SMPQ	26	46.1 N	12.5 W	00	18	M 60	.5 NM	64	0989.0	14.0	15.0	5	13	22	9	19.5
AMERICAN ACE	KFCV	26	48.1 N	34.5 W	00	29	50	10 NM	02	0988.5	7.2	12.3	5	24.5	29	< 6	29.5
SEALAND GALLOWAY	KHLX	26	48.1 N	31.5 W	06	29	53	10 NM	01	0987.8	6.1	12.2	8	14.5	32	12	26
FALSTRIA	OYBG	26	40.6 N	34.5 W	16	23	M 52	1 NM	91	0994.2	17.2		8	13	33	10	13
IFL FREEDOM	9VXX	26	48.2 N	46.5 W	18	29	M 45	10 NM	24	0994.3	0.0	5.9	12	26	28	13	23
IFL FREEDOM	9VPX	27	47.9 N	47.9 W	00	30	M 47	5 NM	66	1002.0	- 2.0	2.5					
OGDEN FRASER	SMPQ	27	43.4 N	18.2 W	12	26	M 60	10 NM	01	0986.0	15.0	16.0	6	13	25	8	26
SEALAND GALLOWAY	KHLX	27	44.3 N	41.6 W	12	28	50	5 NM	27	1008.5	16.0	14.4	8	14.5	30	13	31
AMERICAN LEGEND	KFEY	27	43.4 N	40.4 W	12	26	60	5 NM	26	1010.0	5.0	10.5	5	13	28	11	19.5
AMERICAN ACE	KFCV	27	46.3 N	45.4 W	12	29	55	5 NM	26	1013.0	0.0	4.4	7	26	31	6	29.5
FALSTRIA	OYBG	27	42.9 N	26.8 W	18	29	M 50	2 NM	27	0988.1	9.6		12	19.5			
CHARLES PIGOTT	SLPA	27	37.4 N	25.3 W	18	27	M 48	10 NM	15	1008.6	16.2	17.7	14	19.5			
AMERICAN LEGEND	KFEY	28	43.7 N	36.1 W	00	28	50	5 NM	26	1007.5	5.0	16.8	7	13	28	11	19.5
CHARLES PIGOTT	SLPA	28	37.3 N	23.2 W	06	30	M 50	10 NM	13	1007.8	13.5	18.3					
FALSTRIA	OYBG	28	44.4 N	21.4 W	12	29	M 50	2 NM	27	0977.1	12.1		12	19.5			
OGDEN FRASER	SMPQ	28	41.2 N	21.0 W	18	29	M 55	5 NM	01	0991.0	11.0	16.0	6	14.5	30	9	26
OGDEN FRASER	SMPQ	29	40.9 N	21.3 W	00	29	M 60	10 NM	25	0995.0	12.0	16.0	5	14.5	30	9	26
FALSTRIA	OYBG	29	45.5 N	20.0 W	00	30	M 60	2 NM	27	0970.0	11.3		15	26			
AMERICAN LEGEND	KFEY	29	45.2 N	24.0 W	00	32	50	10 NM	02	0990.4	12.0	15.7	7	13	30	< 6	16.5
CHARLES PIGOTT	SLPA	29	38.9 N	18.0 W	16	22	M 65	2 NM	64	0992.9	14.0	17.7	12	16.5			
CHARLES PIGOTT	SLPA	30	36.8 N	17.0 W	00	23	M 60	2 NM	64	0985.8	17.2	17.7					
OGDEN FRASER	SMPQ	30	38.5 N	26.8 W	12	29	M 45	10 NM	01	0997.0	14.0	17.0	5	13	28	9	21
GUADALUPE I	EAFI	31	38.9 N	56.5 W	12	30	55	5 NM	95	1001.2	7.0	17.2	4	13	30	6	21
SEALAND LEADER	WSNM	31	39.5 N	53.9 W	18	31	M 64	5 NM	81	1003.9	9.0	16.0	5	19.5	31	6	29.5
SEALAND ECONOMY	WNDJ	31	41.7 N	50.6 W	18	29	45	1 NM	62	0990.9	5.0	11.7	7	11.5	29	10	36
GREAT LAKES VESSELS																	
JOHN G MUNSON	9882	8	47.8 N	86.9 W	06	02	M 40	5 NM	73		- 5.0	0.0		13			
ENVIRONMENTAL BUOYS																	
44001		05	34.7N	072.3W	14	34	MM2			1005.3	11.5	20.9	4	14			
44005		06	42.7N	068.3W	05	02	MM4			987.6	5.5	8.5	4	12			
44005		16	42.7N	068.3W	17	23	MM6			985.9	4.5	8.1	4	14			

+ Direction for sea waves same as wind direction
X Direction or period of waves indeterminate
M Measured wind

NOTE: The observations are selected from those with winds ≥ 35 kn or waves ≥ 25 ft from May through August (≥41 kn or ≥33 ft, September through April). In cases where a ship reported more than one observation a day with such values, the one with the highest wind-speed was selected.

North Pacific Selected Gale and Wave Observations

October, November and December 1981

Vessel	Nationality	Date	Position of Ship		Time GMT	Wind			Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C		Sea Waves†		Swell Waves		
			Lat. deg.	Long. deg.		Dir. 10°		Speed kt.				Air	Sea	Period sec.	Height ft.	Dir. 10°	Period sec.*	Height ft.
NORTH PACIFIC OCEAN		OCT.																
LESLIE LYKES	WHTU	1	24.5 N	176.6 E	00	21		47	5 NM	02	1001.7	27.2	28.9	5	6	22	8	24.5
PRESIDENT FILLMORE	KRDH	1	26.5 N	139.8 E	12	21		55	10 NM	61	0999.2	27.8	26.1	7	14.5	25	>13	41
PRESIDENT JEFFERSON	WPGL	1	35.7 N	142.0 E	18	06	W	50	5 NM	07	0991.0	21.7	28.6	2	8	06	11	13
PRESIDENT VAN BUREN	WAPI	2	35.9 N	150.6 E	06	15		70	2 NM	62	0967.0	26.1	23.9	6	13	15	12	10
UNITED SPIRIT	KMKM	2	41.4 N	145.7 E	18	33	W	45	2 NM	07	0991.6	12.0	16.0	8	16.5	33	11	16.5
SIMA	OWFC	2	36.4 N	150.6 E	18	27	W	48	1 NM	07	0989.5	16.6	19.5	8	16.5	22		
KANOKOSTEEL	KLSN	2	43.0 N	157.1 E	23	17	W	58	200 YD	18	0996.4	18.0	20.0	12	26	17	>13	26
PRESIDENT JEFFERSON	WPGL	3	37.6 N	152.8 E	00	27	W	38	10 NM	01	0994.1	20.6	22.2	5	10	27	9	27.5
SIMA	OWFC	3	38.1 N	152.4 E	00	27	W	46	5 NM	01	0994.5	19.7	18.0	8	19.5	30		
SAN CONQUEROR	ABIB	3	48.6 N	158.7 E	00	10	W	60	.5 NM	63	0980.0	11.0	12.0					
KANOKOSTEEL	KLSN	3	43.6 N	162.9 E	05	20	W	57	2 NM	01	0992.0	15.0	16.0	12	26	20	8	29.5
SAN CONQUEROR	ABIB	4	46.1 N	157.3 E	00	22	W	50	1 NM	60	0972.0		6.0	12	40			
TYSON LYKES	WSCU	4	43.3 N	153.6 W	06	26		20	5 NM	61	1009.5	17.2	13.3	3	41	25	7	13
CALIFORNIA RAINBOW	JNJL	4	52.9 N	172.1 E	18	06	W	47	1 NM	10	1000.6	11.0	11.0	4	10	16	< 6	10
YELLOW SHEC 717	NOTT	5	56.2 N	165.4 W	06	32	W	49	10 NM	58	1005.1	4.9	11.1		11.5	00		0
MOBILE MERIDIAN	KGSM	5	51.3 N	170.3 W	12	11		45	5 NM	61	0995.7	11.7	12.7	10	14.5			
COPIA COPIA	KFJC	5	52.2 N	173.4 W	18	10		50	5 NM	81	0980.0	9.4	12.8	6	19.5	15	7	16.5
TYSON LYKES	WSCU	5	45.1 N	172.4 W	18	16		17	5 NM	02	1021.9	12.2	10.6	2	3	25	11	41
HOHSING BREEZE	TCDU	6	49.3 N	145.6 W	00	31	W	44	5 NM	23	0999.6	6.0	12.0	8	19.5	31	11	16.5
ARCO ANCHORAGE	WCIO	6	44.9 N	171.0 W	00	27		50	5 NM	02	0995.0	15.0		8	13	28	9	13
MOBILE MERIDIAN	KGSM	6	52.5 N	174.1 W	00	08	W	43	200 YD	63	0971.4	10.2	12.2	XX	16	11	6	8
SEALAND MARINER	WGJF	6	43.2 N	142.7 W	06	29	W	47	10 NM	02	1007.0	12.0	14.0	5	6.5	35	9	11.5
TYSON LYKES	WSCU	6	45.1 N	177.2 W	06	13		10	2 NM	56	1014.2	12.2	10.6	1	1.5	25	9	76
PERENNIAL ACE	HOMU	6	51.2 N	134.1 W	15	15	W	41	1 NM	02	0980.0	10.0	13.0	2	10	15	6	13
KOREAN PRIDE	FLXF	6	51.4 N	175.1 W	18	11	W	45	2 NM	10	0980.0	9.0	13.0	8	13	15	8	76
ARCO ANCHORAGE	WCIO	7	48.2 N	134.6 W	00	29		55	5 NM	02	0985.0	12.3		12	46	29	12	46
YELLOW SHEC 717	NOTT	7	56.9 N	162.3 W	00	30	W	45	5 NM	03	0998.3	4.0	11.1	5	6.5	00		0
PACIFIC VENTURE	WDVS	7	48.1 N	172.0 W	12	29	W	45	1 NM	60	0992.5	14.6	11.0	8	13	29	8	19.5
MING GLORY	BLMX	10	38.6 N	165.3 E	06	21	W	41	< 50 YD	02	1010.0	20.5	20.6					
SEALAND EXPLORER	WGJF	14	37.6 N	147.3 E	05	16	W	49	10 NM	21	1003.8	21.5	29.0	5	10	14	< 6	13
PACIFIC VENTURE	WDVS	14	44.6 N	153.0 E	18	15	W	50	.5 NM	18	0997.0	11.0		5	8	15	11	10
PERENNIAL ACE	HOMU	14	40.4 N	147.1 E	18	31	W	43	5 NM	03	1010.0	11.0	18.0	1	5	26	< 6	10
FAGBARON	ABYI	15	45.2 N	159.2 E	00	13	W	41	.5 NM	02	1009.0	11.0	11.0	7	10	14	9	19.5
WESTWARD VENTURE	KHJB	16	51.6 N	171.3 W	00	27	W	20	.5 NM	46	1022.0	13.9	11.7	4	5	27	8	32.5
PRESIDENT JOHNSON	WVHS	16	46.9 N	172.6 E	18	30		50	2 NM	02	0992.6	7.8	7.8	10	16.5	31	>13	16
OMCO TRADER	KLCI	16	16.6 N	133.5 E	21	21		45	.5 NM	65	0996.6	26.5		7	14.5	36	9	19.5
OMCO TRADER	KLCI	19	17.0 N	134.1 E	00	19		50	.5 NM	64	0997.8	26.5		9	16.5	34	10	19.5
SEALAND DEFENDER	WGJB	19	45.1 N	161.1 E	00	29	W	41	5 NM	02	1010.2	9.5	10.0	4	8	29	< 6	10
MING ON	MJND	19	51.6 N	164.1 W	00	13	W	45	.5 NM	63	1003.5	10.0	10.0	12	19.5	12	9	21
STELLA LYKES	WNJA	19	20.3 N	125.5 E	18	01		47	2 NM	02	0999.6	27.3	26.7					
PRESIDENT MC KINLEY	WWFZ	20	24.1 N	179.6 E	03	02		50	5 NM	14	1001.2	26.7	26.7	4	6	11	>13	19.5
GLENS WTY BRIDGE	JHJL	21	37.6 N	178.2 W	06	16	W	44	2 NM	63	0998.2	20.0		4	10	14	6	11.5
ARCO ALASKA	WSPR	21	55.1 N	143.6 W	06	13	W	44	2 NM	63	1021.0	8.3	9.4			13	8	13
ARTES	KGBU	21	25.5 N	134.0 E	18	19	W	67	5 NM	18	0992.3	26.0	26.1	9	19.5	27	10	
ARTES	KGBU	22	25.4 N	133.9 E	00	24	W	58	5 NM	18	0997.8	26.0	26.1	9	16.5	24	10	32.5
AMERICA SUN	WVFU	24	48.3 N	165.5 W	00	15	W	45	2 NM	02	0993.0	13.8	11.7	8	14.5	20	8	16.5
ELIZABETH LYKES	KHTP	24	34.4 N	176.4 E	00	28		42	5 NM	07	0997.3	19.4	24.4	10	19.5	21	8	11.5
HARBOR PRIDE	CYFY	24	53.0 N	166.7 W	18	17		42	5 NM	02	1006.3	17.2	16.0	7	21	18	8	16.5
ODDEN DANUBE	FLCU	24	32.4 N	176.2 E	06	05	W	30	2 NM	21	0998.9	23.0	24.0	12	16.5	05	>13	32.5
EVER VALUE	HSNH	24	33.8 N	176.7 W	12	27	W	44	5 NM	02	1000.0	17.0	21.5					
OMCO TRADER	KLCI	22	32.4 N	140.5 E	12	14		60	.25 NM	65	0975.5	25.0				12		23
NEPTUNE DIAMOND	CWYI	22	38.1 N	144.6 E	12	16	W	48	5 NM	51	1014.4	17.8						
JAPAN APOLLO	JKZL	22	50.6 N	162.6 W	12	14	W	51	.5 NM	61	0991.5	10.5						
AMERICAN ASTRONAUT	WJJG	22	39.6 N	174.7 W	18	33		32	10 NM	02	1003.7	14.0	17.3	5	24.5	33	8	32.5
TIM MONTREAL	AZKM	22	35.6 N	149.7 E	22	16	W	45	< 50 YD	02	0992.6	20.6	22.6	XX	3	16	7	29.5
TIM MONTREAL	AZKM	23	35.7 N	149.4 E	00	16	W	50	.25 NM	60	0991.5	20.0	22.0	XX	16.5	11	6	29.5
AMERICAN ASTRONAUT	WJJG	23	39.6 N	172.5 W	00	33		37	10 NM	02	1006.5	14.5	18.4	5	16.5	33	9	32.5
OLINTINA	OSFU	23	43.6 N	147.7 E	00	14		45	200 YD	05	0975.0	12.0	23.0	6	6.5	18	8	10
VENISIA	AECY	23	43.4 N	146.8 E	00	16	W	48	1 NM	10	0972.5	13.0	12.6	6	16.5	16	10	24.5
VICTORIOUS	JFYC	23	21.4 N	172.3 E	05	04	W	45	2 NM	03	1016.0	24.0						
UNITED SPIRIT	KMKM	23	52.2 N	156.8 W	06	17	W	55	.5 NM	50	1005.0	11.0	10.0	10	13	17	11	16.5
PRESIDENT TAFT	WLDI	23	35.0 N	141.9 E	06	23		45	10 NM	02	0997.0	21.1	19.4	4	6.5			
PACMAJESTY	DSGO	23	43.6 N	153.0 E	06	14	W	50	200 YD	60	0973.3	13.5	7.0	5	16.5	14	>13	39
ARCTIC TOKYO	SLJT	23	42.7 N	156.6 E	12	22	W	30	2 NM	18	0998.0	12.0	10.0	10	32.5	25	< 6	
OLINTINA	OSFU	24	42.0 N	143.9 E	00	25		45	5 NM	03	0994.0	8.5	24.0	5	6.5	25	7	11.5
SAN CONQUEROR	ABIB	24	47.4 N	169.6 E	00	17	W	45	2 NM	60	1010.5	7.0	10.0					
UNITED SPIRIT	KMKM	25	51.0 N	174.7 W	00	20	W	44	2 NM	62	1024.5	10.0	10.0	7	13	20	7	19.5
OCEANOGRAPHER	WTEP	25	54.3 N	164.2 W	12	24	W	42	10 NM	02	1017.0	8.1	8.8	4	5	24	6	10
DIANA	DSJV	26	54.1 N	173.3 W	21	31	W	41	5 NM	03	1009.0	6.0	9.0	12	16	31	12	16
DIANA	DSJV	27	53.0 N	153.9 W	03	31	W	41	10 NM	03	1000.4	7.0	9.0	12	23	31	>13	23
EVER VALLE	HSNH	27	33.1 N	146.8 E	06	04	W	41	2 NM	21	1011.7	19.5	23.0	5	23	04	10	10
SEA LAND VOYAGER	KHRK	27	43.3 N	146.2 W	12	30	W	43	10 NM	02	1007.8	12.5	13.0	7	8	31	12	19.5
PRESIDENT GARCIA	OWEL	27	36.2 N	152.4 E	18	06	W	42	.5 NM	02	1019.5	15.5	10.0					
TONSINA	KJDG	27	15.2 N	173.4 W	21	10		60	2 NM	62	0998.5	26.7	27.2	7	13	XX		16.5
TONSINA	KJDG	28	15.2 N	173.2 W	00	14		60	2 NM	60	1003.2	26.7	27.2	7	13	XX		16.5
SEA LAND VOYAGER	KHRK	28	42.2 N	161.0 W	00	31	W	42	10 NM	16	1002.8	15.6	14.0	6	8	31	12	16.5
P T ALASKA	WFQE	28	18.6 N	104.9 W	21	14	W	48	2 NM	64	1004.2	24.4	30.6	5	16	16	6	23
P T ALASKA	WFQE	29	18.5 N	104.6 W	00	17	W	42	1 NM	61	1005.8	25.6	30.6	4	16.5	17	>13	23
HANJIN POHANG	DSQN	29	41.4 N	178.2 W	00	29	W	48	10 NM	01	1000.1	14.5	17.0	6	13	23	< 6	10
OCEANOGRAPHER	WTEP	29	59.5 N	170.1 W	18	35	W	46	10 NM	02	1002.0	- 1.4	4.6	6	10	34	6	19.5
OCEANOGRAPHER	WTEP	30	59.6 N	170.3 W	00	35	W	50	5 NM	02	1003.4	- 1.5	4.3	6	10	34	6	24.5
PRESIDENT MC KINLEY	WWFZ	30	37.6 N	146.3 E	06	35		48	5 NM	02	1014.2	13.9	16.3	4	6.5	36	8	11.5
KUNO WHEC 724	NGDF	30	51.5 N	169.5 W	06	33	W	42	5 NM	02	1010.9	7.7	7.7	3	8			
WESTWARD VENTURE	KHJB	30	50.6 N	179.5 W	12	16	W	45	5 NM	81	0997.0	10.0	11.3	4	8			
CHEVRON ARIZONA	KGBE	30	52.0 N	155.2 W	12	27	W	45	5 NM	88	0990.0	3.3		3	19.5	30	6	13
OVERSEAS NEW YORK	WMCK	30	50.5 N	174.3 W	18	20		50	1 NM	50	0980.2	13.3	11.1	6	14.5	20	11	16
MING ON	MJND	30	52.4 N	175.5 W	18	26	W	43	10 NM	80	0977.0	11.0	14.0	5	16.5	14	9	23
HANJIN POHANG	DSQN	30	46.3 N	141.7 W	18	32	W	41	10 NM	01	0997.0	11.5	14.0	10	16	32	7	13
EASTERN WORLD	ELVA	30	45.1 N	156.3 E	23	06	W	41	1 NM	05	1017.0	9.0	8.0	5	13	05	10	13
MING GLORY	BLMX	31	44.5 N	167.2 E	12	12	W	48	.25 NM	21	1021.0	12.0	12.0					
OVERSEAS NEW YORK	WMCK	31	55.6 N	140.3 W	18	19		50	5 NM	56	0995.5	6.1	9.4	7	11.5	20		14.5

Vessel	Nationality	Date	Position of Ship		Time GMT	Wind		Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C		Sea Waves?			Swell Waves		
			Lat. deg.	Long. deg.		Dir. 10°	Speed kt.				Air	Sea	Period sec.	Height ft.	Dir. 10°	Period sec.	Height ft.	
NORTH PACIFIC OCEAN		NOV.																
SKAUGRAN	LMUK	1	41.3 N	179.8 E	06	18	M 25	2 NM	58	1020.0	16.9							
PRESIDENT MADISON	WCIP	2	50.6 N	170.8 W	18	07	42	10 NM	02	1000.5	8.3	4.4	5	8				
DIAMOND PHOENIX	DSMS	2	38.8 N	135.4 E	18	34	M 44	5 NM	41	0996.8	16.0	17.5						
DIAMOND PHOENIX	DSMS	3	40.8 N	139.3 E	06	27	M 44	> 25 NM	05	1007.8	10.5	13.0	9	10	27	10	11.5	
SKAUGRAN	LMUK	3	39.7 N	159.8 E	12	19	M 45	1 NM	00	1015.0	14.7							
SEALAND DEFENDER	KGJB	3	41.1 N	166.7 W	18	24	M 45	5 NM	01	0997.2	14.0	16.0	9	24.5	26	10	29.5	
WASHINGTON WOOD	JEOV	4	54.1 N	163.8 W	18	32	M 45	5 NM	03	1001.2	3.0	7.5	5	6.5	32	< 6	8	
ARCO ANCHORAGE	WCIO	4	57.4 N	143.2 W	18	22	44	5 NM	02	0995.0	1.5		8	13	23	6	16.5	
PRESIDENT MADISON	WCIP	4	51.7 N	143.6 W	18	21	36	5 NM	05	0998.4	11.1	5.6	2	13	28	< 6	23	
WASHINGTON WOOD	JEOV	5	54.3 N	164.8 W	00	32	M 45	5 NM	29	1001.8	3.0	7.3	5	6.5	32	< 6	8	
SEALAND INNOVATOR	WGNF	5	42.3 N	175.0 W	00	36	M 42	10 NM	02	1016.8	13.8	13.0	1	8	36	6	19.5	
OVERSEAS NEW YORK	WMCK	5	52.6 N	136.4 W	06	22	50	2 NM	07	1006.5	12.8	9.4	11	24.5	22	12	28	
PRESIDENT MADISON	WCIP	5	50.8 N	137.1 W	06	18	50	5 NM	05	1010.4	11.7	7.8	2	13	18	< 6	23	
CORNUCOPIA	KPJC	5	56.9 N	151.0 W	12	27	55	5 NM	72	0996.1	- 3.7	7.8	3	6.5	27	< 6	8	
BARBER TAIF	LIBD	6	46.7 N	169.6 W	00	15	56	2 NM	63	0994.0	11.1		7	16.5				
MUNRO WHEC 724	NGDF	6	47.9 N	170.4 W	00	16	M 46	2 NM	05	0993.5	8.2	9.4	5	8				
EASTERN FORTUNE	ELNZ	6	45.9 N	169.0 W	00	16	M 42	200 YD	63	0995.0	8.0		7	19.5	16	9	26	
ALASKA STANDARD	WHDN	6	54.5 N	163.7 W	12	16	45	5 NM	02	0996.5	5.0		2	6.5	16	6	6.5	
MAFIA RUBICON	9VDY	6	51.6 N	160.3 W	12	16	M 30	2 NM	65	0982.0	9.0	7.0	14	19.5	17	>13	39	
EASTERN VENTURE	JGWT	6	49.2 N	154.6 W	18	17	45	2 NM	61	1002.0	7.0	9.5	8	16.5	17	11	16.5	
JARVIS WHEC 725	NAOD	6	54.2 N	160.9 W	21	11	M 42	1 NM	63	0982.0	5.3	6.7	5	6.5	16	6	8	
PACBARON	A8YI	6	54.0 N	156.6 W	23	14	M 50	1 NM	07	0984.0	7.0	9.0	5	16.5	16	9	32.5	
MAFIA RUBICON	9VDY	7	51.6 N	158.6 W	00	16	M 17	2 NM	21	0986.0	8.0	7.0	12	8	17	>13	37.5	
EASTERN VENTURE	JGWT	7	49.1 N	153.6 W	00	16	45	1 NM	61	0999.5	6.0	9.5		16.5	16	11	16.5	
OCEANOGRAPHER	WTEP	7	57.9 N	167.2 W	12	03	M 43	5 NM	02	0981.0	2.8	4.7	6	3	06	6	10	
ARCO ANCHORAGE	WCIO	7	53.9 N	136.5 W	19	09	50	5 NM	02	1008.2	6.0		4	18	27	6	18	
CHEVRON CALIFORNIA	WCGN	8	58.7 N	150.9 W	00	13	45	10 NM	02	0995.3	7.2	7.2	1	13	13	< 6	19.5	
SEALAND MARINER	KGJF	8	42.9 N	177.4 W	06	23	M 45	5 NM	81	0997.5	10.0	12.0	5	10				
ENNA G	C2DG	8	36.9 N	168.5 W	06	22	33	2 NM	60	1001.7	18.8	18.0	3	10	24	9	32.5	
PRESIDENT TYLER	WEZM	8	38.2 N	165.2 E	18	18	M 53	5 NM	63	0997.7	17.2	20.0	8	19.5				
CALLFON AQUAMARINE	DZMA	8	39.8 N	171.6 W	12	29	M 50	5 NM	03	1002.0	13.0	15.0	11	8	29	11	11.5	
ENNA G	C2DG	9	37.5 N	163.4 W	00	29	40	5 NM	01	1011.2	15.0	16.0	4	10	30	9	32.5	
TOYOTA MARU 12	JRJO	9	36.6 N	157.6 W	00	29	M 42	5 NM	02	1006.4	15.5	18.5	10	19.5	30	>13	26	
EWER SMOKE	WPEI	9	42.1 N	157.9 E	00	27	M 42	10 NM	01	1004.0	9.0	11.0	11	14.5	27	11	14.5	
PRESIDENT TYLER	WEZM	9	38.9 N	173.7 E	06	27	M 35	5 NM	03	1007.4	16.6	16.7	10	32.5				
VAN CONQUEROR	A8IB	9	51.7 N	146.8 W	12	05	M 45	5 NM	60	0972.0	6.0	10.0						
GENISTA	A8CY	9	51.2 N	144.2 W	18	09	M 50	5 NM	04	1006.5	16.0	14.0	6	16.5	09	6	29.5	
VICTORIOUS	3FYC	9	49.3 N	134.8 W	21	13	M 50	200 YD	53	0997.0	11.0							
CHEVRON CALIFORNIA	WCGN	9	54.1 N	144.2 W	21	15	50	2 NM	53	0979.2	11.7	8.3	6	16.5				
EASTERN FORTUNE	ELNZ	9	47.6 N	144.8 W	23	23	M 56	.5 NM	62	0971.0	7.0		10	24.5	23	>13	29.5	
ORIENTAL EXECUTIVE	DSAN	10	36.9 N	167.5 W	00	26	M 50	10 NM	01	1000.3	17.0							
ARCO FAIRBANKS	WGWB	10	52.3 N	134.7 W	00	14	M 43	5 NM	80	0995.2	12.8	12.8	8	13				
MANHATTAN	WJAF	10	52.2 N	134.2 W	00	14	57	2 NM	02	0994.6	12.3	10.6	8	19.5	13	8	23	
MOBIL ARCTIC	KSPY	10	55.6 N	179.0 W	00	13	50	5 NM	02	0986.0	11.2	6.5	4	5	13	6	31	
WESTWARD VENTURE	KHJB	10	56.4 N	149.0 W	00	09	48	1 NM	61	0973.1	7.8	7.7		13				
CHEVRON CALIFORNIA	WCGN	10	54.0 N	140.7 W	06	16	60	5 NM	18	0973.5	10.0	8.9			16	10	42.5	
VAN CONQUEROR	A8IB	10	52.6 N	154.0 W	06	30	M 42	5 NM	02	0955.0	4.0	9.0						
CALLFON AQUAMARINE	DZMA	10	36.1 N	174.3 W	12	27	M 56	5 NM	07	0998.0	14.0	16.0	5	16.5	27	< 6	16.5	
ALEUTIAN DEVELOPER	WIPL	10	57.9 N	146.9 W	12	11	55	2 NM	62	0961.3	7.8	6.1	12	16.5	13	9	16.5	
YOUNG SCOPE	6ZLM	10	56.7 N	145.4 W	12	15	M 50	2 NM	07	0965.0	12.0	11.0	7	16.5	13	>13	29.5	
MUNRO WHEC 724	NGDF	10	51.5 N	175.3 W	12	29	M 41	10 NM	01	0994.5	5.1	7.8	5	8				
PACIFIC ARROW	JGFM	10	37.4 N	139.8 W	12	22	M 42	2 NM	01	1007.6	18.0	18.5	6	10	30	13	32.5	
CORNUCOPIA	KPJC	10	56.5 N	152.3 W	18	11	55	2 NM	02	0962.5	7.7	7.2	5	8	12	6	32.5	
NEWARK	WNDO	10	57.6 N	146.6 W	18	14	M 45	5 NM	01	0971.9	6.7	7.2	8	23	15	9	29.5	
MING STAR	BLMV	10	53.7 N	159.2 W	18	28	M 47	2 NM	58	0988.0	5.0	8.0						
DIAMOND PHOENIX	DSMS	11	51.2 N	180.0 W	00	12	M 44	10 NM	07	0962.2	10.5	9.8	7	8	17	9	13	
MILLER FREEMAN	WTDM	11	58.0 N	152.2 W	00	13	M 42	5 NM	00	0966.8	8.8	7.5		5	12	>13	29.5	
MANHATTAN	WJAF	11	48.7 N	130.8 W	00	15	50	2 NM	63	0990.2	12.8	12.2	7	19.5	16	9	23	
PORTLAND	WNDF	11	58.3 N	149.2 W	00	12	M 42	5 NM	53	0971.7	7.3	6.6	6	11.5	11	>13	23	
GREAT LAND	WFDP	11	54.4 N	137.9 W	00	12	M 47	1 NM	61	0965.7	9.5	10.0	4	10	12	8	19.5	
CORNUCOPIA	KPJC	11	58.7 N	149.9 W	00	11	50	2 NM	02	0971.2	7.2	7.2	7	8	15	8	32.5	
KEIYO	JKMG	11	50.3 N	146.1 W	03	27	M 42	10 NM	02	0971.5	6.5	8.0	6	6.5	30	6	8	
PACIFIC ARROW	JGFM	11	35.8 N	144.0 W	06	27	M 36	1 NM	01	1010.0	16.5		6	16	30	>13	39	
BLUE OCEAN	JKOH	11	53.9 N	144.9 W	06	27	M 55	2 NM	60	0955.0	6.0	7.0	5	21	27	7	26	
TONSINA	WJDG	11	52.3 N	135.8 W	06	18	40	2 NM	02	0974.5	11.1	10.0	6	14.5	18	9	32.5	
MOBILE MERIDIAN	KGSM	11	45.5 N	176.4 W	06	18	45	5 NM	07	0997.6	14.4	13.9	3	19.5	25	8	18	
ARCO FAIRBANKS	WGWB	11	58.7 N	143.2 W	06	11	M 48	5 NM	02	0967.0	7.8	7.8						
CHESNUT HILL	WWFX	11	41.6 N	135.8 W	06	22	45	2 NM	02	0992.4	15.0	14.4		16.5	23		23	
PACIFIC ERA	ELUD	11	34.4 N	154.7 W	06	30	30	10 NM	01	1020.0	16.0	18.0	5	19.5	29	12	42.5	
ENNA G	C2DG	11	37.1 N	147.7 W	06	30	26	10 NM	02	1012.0	13.8	15.0	3	11.5	30	>13	32.5	
MOBIL ARCTIC	KSPY	11	54.1 N	136.3 W	11	19	45	10 NM	02	0975.0	9.4	6.6	3	6.5	18	9	34.5	
CHEVRON CALIFORNIA	WCGN	11	52.4 N	138.4 W	12	24	60	10 NM	02	0977.0	8.3	8.9	2	10	XX	< 6	21	
SEALAND LIBERATOR	KHRP	11	43.6 N	175.0 W	12	16	M 45	5 NM	10	1007.5	15.0	13.0	8	23				
JARVIS WHEC 725	NAOD	11	56.2 N	170.8 W	18	31	M 44	5 NM	87	0986.2	2.6	6.5	5	8	00		0	
AFRICAN STARS	3FHS	12	13.8 N	145.0 W	00	08	M 41	5 NM	02	1009.0	27.0	26.0	8	13	09	8	13	
TONSINA	WJDG	12	55.4 N	177.1 W	06	20	25	10 NM	02	0989.8	8.3	8.3	6	19.5	22	9	32.5	
OCEANOGRAPHER	WTEP	12	54.4 N	167.0 W	12	31	M 42	10 NM	02	0993.0	4.0	6.2	5	5	32	6	16.5	
CHESNUT HILL	WWFX	12	39.9 N	141.3 W	18	25	40	10 NM	01	1003.6	12.2	15.6	XX	10	28	9	36	
CHESNUT HILL	WWFX	13	39.9 N	142.3 W	00	27	40	> 25 NM	01	1001.0	13.3	15.6	XX	10	28	9	36	
GOLDEN GATE BRIDGE	UPZD	13	32.6 N	140.9 W	12	29	M 42	5 NM	02	1005.0	19.0	23.0	8	13	29	11	18	
AMERICA MARU	JNXV	13	36.3 N	133.4 W	18	27	M 60	1 NM	02	0986.5	14.0	15.0	4	8	21	6	14.5	
P T ALASKA	WFQE	13	39.9 N	176.1 W	18	15	M 46	1 NM	59	0996.2	14.4	15.6	5	10	31	9	19.5	
CALLFON AQUAMARINE	DZMA	13	35.5 N	171.6 W	18	25	M 50	5 NM	03	0993.0	17.0	19.0	12	10	25	12	13	
ORIENTAL EXECUTIVE	DSAN	13	35.7 N	171.5 W	18	25	M 44	2 NM	12	0996.5	19.0							
CALLFON AQUAMARINE	DZMA	14	35.8 N	179.2 W	00	26	M 44	10 NM	07	1000.0	17.0	17.0	5	19.5	26	< 6	19.5	
ENNA G	C2DG	14	37.5 N	127.5 W	06	23	40	5 NM	01	0994.7	16.0	15.0	4	11.5	22	12	32.5	
PACMERCHANT	SMCB	14	40.1 N	158.2 E	00	14	M 47	2 NM	61	1007.0	14.0	15.0	5	16.5	14	6	6.5	
AMERICA MARU	JNXV	14	37.7 N	130.7 W	06	26	M 50	1 NM	01	0991.0	14.5	19.0	3	10	26	9	26	
SEALAND LIBERATOR	KHRP	14	42.4 N	127.9 W	06	24	M 50	2 NM	63	0967.5	13.5	13.0						
PRESIDENT CLEVELAND	PGXA	14	42.6 N	125.0 W	06	20	60	.5 NM	02	0978.7	15.6	12.7	4	8	20	>13	28	
P T ALASKA	WFQE	14	42.0 N	127.6 W	06	25	M 90	.5 NM	07	0973.5	12.2	14.4	5	32.5	28	8	39	
CHEVRON CALIFORNIA	WCGN	14	42.3 N	127.3 W	10	24	95	.25 NM	02	0982.8	13.9	13.9	1	13	24	8	23	
PRESIDENT MADISON	WCIP	14	33.3 N	131.7 W	12	23	27	10 NM	02	1012.0	18.3	16.9	4	6.5	23	6	32.5	
CORNUCOPIA	KPJC	14	47.9 N	127.5 W	12	08	45	2 NM	81	0972.3	11.2	11.7	3	8	09	< 6	8	
BLUE OCEAN	JKOH	14	54.2 N	163.5 W	12	32	M 52	5 NM	02	1006.0	3.6	9.0	5	13	32	6	14.5	
PRESIDENT MADISON	WCIP	15	33.2 N	135.2 W	00	22	28	10 NM	02	1010.6	20.6	17.8	5	6.5	29	6	32.5	
PACMERCHANT	SMCB	15	39.8 N	164.9 E	00	31	M 45	5 NM	02	1008.0	11.5	16.0	5	1.5	31	6	10	
CHESNUT HILL	WWFX	15	39.8 N	155.3 W	18	33	45	10 NM	18	1013.8	10.0	12.8	XX	10	33	13	32.5	
MOBILE MERIDIAN	KGSM	15	44.8 N	127.0 W	18	36	45	5 NM	25	0986.5	10.0	12.2	3	19.5	XX			
CHESNUT HILL	WWFX	16	38.4 N	150.2 W	00	33	40	10 NM	03	1016.1	10.0	18.3	XX	10	33	13	32.5	
PRESIDENT PIERCE	WURV	16	49.2 N	179.3 E	00	30	48	2 NM	62	0985.0	6.7	6.7	7	19.5	30	6	19.5	
VAN CONQUEROR	A8TB	16	53.3 N	175.4 E	00	33	M 42	5 NM	60	0997.0	3.8	10.0						
VAN CONQUEROR	A8IB	17	52.1 N	148.9 E	00	15	M 44	5 NM	02	0994.0	7.0	11.0						
CHEVRON ARIZONA	WGBE	17	38.6 N	129.2 W	00	16	M 45	1 NM	63	1007.0	15.6		4	19.5	18	6	23	

Vessel	Nationality	Date	Position of Ship		Time GMT	Wind		Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C		Sea Waves*			Swell Waves		
			Lat. deg.	Long. deg.		Dir. 10°	Speed kt.				Air	Sea	Period sec.	Height ft.	Dir. 10°	Period sec.*	Height ft.	
NORTH PACIFIC OCEAN		NOV.																
AMERICAN APOLLO	WCOD	17	20.9 N	170.6 E	06	05	M 42	5 NM	01	1014.8	23.4	27.2	6	16.5	04	8	23	
PRESIDENT GRANT	WEZD	17	45.7 N	151.0 E	06	30	M 45	5 NM	26	0996.8	0.0	5.6	4	8				
BLUE OCEAN	JKGH	17	53.3 N	173.0 E	12	16	M 45	1 NM	81	0985.0	7.0	7.0	5	10	16	7	13	
SEALAND DEVELOPER	KHRH	17	45.8 N	154.5 E	18	28	M 45	10 NM	02	1000.0	0.0	5.0	4	19.5	18	6	23	
BLUE OCEAN	JKGH	18	52.7 N	170.8 E	00	21	M 45	5 NM	60	0977.5	6.0	7.0	5	14.5	21	6	14.5	
VAN CONQUEROR	ABIB	18	50.4 N	163.6 E	00	23	M 50	5 NM	70	0974.0	4.0	10.0						
YOUNG SCOPE	6ZLH	18	51.2 N	165.0 E	00	28	M 35	.25 NM	76	0974.8	4.0	9.0	26	23	25	11	32.5	
SHERMAN WHEC 72C	NMHJ	18	57.3 N	173.3 W	12	08	M 50	5 NM	02	0999.5	3.5	4.5	6	10				
UNITED SPIRIT	SMKM	19	48.8 N	127.5 W	00	16	M 44	2 NM	61	1012.8	11.0	12.0	7	10	16	6	8	
PHILADELPHIA	WJGO	19	52.9 N	133.6 W	00	11	M 45	2 NM	63	0991.0	7.8	11.1	6	13				
PHILADELPHIA	WJGO	20	50.3 N	129.5 W	00	27	M 37	10 NM	02	0993.8	10.0	12.2	5	16.5	22	>13	39.5	
SEALAND ENDURANCE	KGJX	20	48.9 N	154.6 W	06	01	M 45	1 NM	52	0977.5	7.2	7.8	6	5	10	8	16.5	
SEALAND MARINER	KGJF	20	52.1 N	153.1 W	06	11	M 44	5 NM	02	0998.0	7.0	7.0	5	5	12	10	10	
ORIENTAL COMMANDER	6ZWU	20	39.5 N	145.5 W	12	27	M 42	10 NM	60	1003.3	10.0	13.0	5	6.5				
PRINCE WILLIAM SOUND	WSDX	20	55.6 N	141.5 W	18	09	41	10 NM	02	0993.8	7.2	9.4			09	6	8	
CARDINIA	ABUA	20	53.8 N	177.2 W	18	26	M 42	10 NM	02	0995.8	5.0	6.0	3	11.5	28	8	19.5	
PRESIDENT FILLMORE	WRDH	20	53.8 N	177.2 W	18	26	48	5 NM	03	0995.2	3.3	6.1	6	8	26	8	19.5	
KEYSTONE CANYON	KSFK	20	51.5 N	176.0 W	18	12	11	2 NM	60	0984.0	10.0	9.4	4	18	13	10	36	
ANDERS MAERSK	OXIT	21	40.3 N	146.0 W	00	26	50	2 NM	21	1003.5	11.0		17	32.5				
ANDERS MAERSK	OXIT	21	40.3 N	146.0 W	00	26	50	2 NM	21	1003.5	11.0							
PRINCE WILLIAM SOUND	WSDX	21	54.3 N	140.4 W	00	06	45	5 NM	21	0981.0	9.0	9.4	3	8	09	7	10	
R T ALASKA	WFQE	21	56.6 N	142.4 W	06	05	M 45	10 NM	03	0983.5	7.2	7.8	4	6.5	XX			
ARCO FAIRBANKS	WGWB	21	40.4 N	124.9 W	06	15	M 47	5 NM	62	1012.0	13.3	13.9						
OGDEN SENEGAL	ABFO	21	49.5 N	164.7 E	06	21	M 41	2 NM	63	0998.0	7.0	4.0	6	10	22	8	16.5	
TOYOTA MARU 10	JKBI	21	46.9 N	151.6 W	06	29	M 45	2 NM	60	0987.8	7.0	6.5						
SAMOA	OXTZ	21	39.4 N	153.0 E	12	28	M 43	10 NM	02	1006.8	10.2	14.5	6	6.5				
NEWARK	WNDO	21	56.7 N	144.5 W	12	07	M 48	5 NM	20	0982.0	5.0	8.3	4	6.5	09	7	10	
KEYSTONE CANYON	KSFK	21	47.9 N	131.3 W	18	22	25	10 NM	03	0993.1	10.0	11.1	6	19.5	22	12	37.5	
KEYSTONE CANYON	KSFK	22	47.4 N	129.4 W	00	23	25	10 NM	01	1000.0	10.6	11.1	6	19.5	23	12	37.5	
ANDERS MAERSK	OXIT	22	38.3 N	135.7 W	00	26	25	10 NM	02	1015.0	17.5		22	32.5				
ANDERS MAERSK	OXIT	22	38.3 N	135.7 W	00	26	25	10 NM	02	1015.0	17.5		22	32.5				
TOYOTA MARU 10	JKBI	22	45.9 N	145.3 W	00	27	M 45	10 NM	15	0995.5	9.0	8.0	10	26	29	10	29.5	
SKAUGRAN	LHUK	22	39.3 N	166.2 E	12	18	M 55	2 NM	65	0998.6	17.0	18.5						
PRINCE WILLIAM SOUND	WSDX	22	48.7 N	135.8 W	12	23	M 45	10 NM	02	0991.5	9.0	10.0	3	10	23	10	19.5	
CHESNUT HILL	WWFX	22	33.0 N	170.4 E	18	19	50	5 NM	18	1000.9	23.3	22.2	XX		XX			
ARCO FAIRBANKS	WGWB	22	48.8 N	170.7 W	18	23	M 45	10 NM	02	1002.0	9.4	12.2	3	5	24	6	13	
PRESIDENT TYLER	WEZM	22	46.0 N	134.7 W	18	27	M 40	5 NM	62	0999.6	6.7	10.0	6	19.5	27	9	42.5	
PRESIDENT HOOVER	WTST	22	43.3 N	179.4 E	23	18	55	1 NM	81	0993.0	13.9	13.9	6	11.5	18	10	29.5	
EASTERN WORLD	ELVA	22	51.7 N	179.2 W	23	23	M 45	1 NM	00	0999.1	8.0	8.5	10	16.5	18	< 6	29.5	
CHESNUT HILL	WWFX	23	32.7 N	169.3 E	00	22	45	5 NM	01	1002.0	23.3	22.8	XX	11.5	XX	>13	23	
PRESIDENT HOOVER	WTST	23	42.7 N	179.7 E	06	19	33	1 NM	53	0992.2	13.9	12.7	5	8	XX		36	
RUTH LYKES	KGHB	23	15.7 N	125.7 E	06	01	45	10 NM	03	1003.7	27.3	27.3	6	14.5	08	6	14.5	
ARCTIC TOKYO	SLJT	23	53.3 N	179.3 E	12	25	M 50	.25 NM	82	0998.3	5.0	3.0	4		36	13	16.5	
OGDEN SENEGAL	ABFO	23	42.3 N	148.8 E	18	19	M 47	2 NM	25	0996.0	6.5	3.0						
ATLANTIC PIONEER	WJWN	23	53.2 N	179.9 E	18	26	M 33	1 NM	03	0979.5	4.5	8.0	6	32.5	26	6	32.5	
VICTORIOUS	3FYC	23	53.5 N	173.6 E	23	22	M 45	.5 NM	72	0971.0	3.0							
ARCTIC TOKYO	SLJT	24	52.7 N	176.5 E	00	25	M 45	.5 NM	82	0982.0	4.0	4.0	4		36	13	16.5	
VICTORIOUS	3FYC	24	53.5 N	173.7 E	02	22	M 45	.5 NM	26	0972.0	3.0							
OGDEN SENEGAL	ABFO	24	40.8 N	146.7 E	06	27	M 50	5 NM	15	1003.0	4.0	7.0	6	19.5	28	10	26	
PRESIDENT FILLMORE	WRDH	24	42.7 N	148.5 E	12	25	45	10 NM	85	1001.1	2.2	7.8	5	10	30	6	16.5	
ATLANTIC PIONEER	WJWN	24	52.5 N	175.5 E	18	25	M 42	2 NM	03	0999.0	4.5	7.0	10	24.5	25	10	24.5	
AMERICAN LANCER	WZJB	24	37.6 N	167.2 E	18	19	45	5 NM	02	1001.5	15.7	18.7	5	11.5	24	8	16.5	
NEWARK	WNDO	24	56.1 N	148.4 W	16	24	47	5 NM	01	0983.6	5.6	6.7	3	24.5				
PHILADELPHIA	WJGO	24	57.4 N	145.1 W	16	20	M 43	2 NM	26	0988.8	6.1	9.4	5	11.5	23	8	19.5	
RED ARROW	SLTT	24	41.3 N	155.6 E	18	28	M 54	5 NM	27	0998.5	7.0	10.5	4	16.5	27	< 6	26	
PHILADELPHIA	WJGO	25	57.9 N	146.8 W	00	26	M 42	10 NM	02	0992.0	5.6	7.8	5	11.5	25	8	29.5	
MANHATTAN	WJAF	25	59.2 N	145.2 W	00	29	60	200 YD	03	0980.4	3.3	8.9	8	24.5	26	12	32.5	
DIANA	DSJV	25	41.6 N	156.0 E	05	24	M 42	5 NM	03	1007.5	4.0	11.2	9	14.5	24	12	10	
SAMOA	OXTZ	25	45.6 N	175.1 W	11	20	45	5 NM	51	1006.2	11.0	9.5	8	11.5				
BOGASARI DUA	PLYA	25	38.4 N	142.4 W	18	33	M 52	5 NM	00	1035.0	14.0	15.0	5	10	33	9	13	
ORIENTAL EXECUTIVE	DSAN	25	54.0 N	145.5 W	18	27	M 44	5 NM	02	1015.0	8.0							
ARCTIC TOKYO	SLJT	25	49.0 N	165.5 E	18	32	M 45	1 NM	81	0993.0	4.0	3.0	5	13	36	< 6	16.5	
RED ARROW	SLTT	25	43.0 N	162.2 E	18	29	M 43	5 NM	70	1007.5	6.0	11.5	6	16.5	27	7	19.5	
VICTORIOUS	3FYC	25	51.5 N	163.5 E	23	27	M 45	200 YD	69	0993.0	0.0							
PEISHU MARU	JDBD	26	47.3 N	138.9 W	00	32	M 44	2 NM	03	1020.5	8.5	9.0	6	13	31	10	23	
PRESIDENT CLEVELAND	WGXA	26	53.5 N	156.7 W	00	20	41	5 NM	02	1008.2	10.0	6.7	4	10	20	< 6	14.5	
ROSE CITY	WGJP	26	44.6 N	138.6 W	06	34	42	5 NM	02	1027.0	9.5	11.7	10	24.5	32	>13	32.5	
ARCTIC TOKYO	SLJT	26	47.9 N	161.8 E	06	32	M 44	1 NM	81	1006.0	3.0	3.0	5	13	36	< 6	16.5	
YAMASHIN MARU	JBES	26	44.4 N	131.2 W	15	35	M 54	200 YD	64	1011.0	10.0	12.5	6	11.5	30	9	23	
ARCO JUNEAU	KSBG	26	43.5 N	128.4 W	18	36	M 45	5 NM	07	1004.1	10.0	8.9	8	11.5	32	12	23	
YAMASHIN MARU	JBES	27	45.2 N	133.0 W	00	31	M 43	2 NM	25	1018.5	13.5	10.5	6	13	34	11	16.5	
AFRICAN STARS	3FHS	27	37.7 N	127.5 W	00	32	M 42	5 NM	06	1006.0	12.0	14.0	4	11.5	30	7	13	
MAUI	WSLH	27	25.1 N	149.4 W	00	05	43	10 NM	02	1020.5	21.7	23.9	4	16.5	07	10	19.5	
PIONEER NO 1	JCAS	28	45.8 N	147.2 W	00	30	M 41	5 NM	15	1001.0	10.0	13.0	4	16.5	31		18	
ASIA HERON	ABDD	28	33.1 N	146.6 E	06	02	M 46	2 NM	25	1009.0	16.0	22.0	4	6.5	00	7	10	
CRESSIDA	3FTG	29	52.3 N	168.9 E	06	12	M 42	2 NM	02	0982.0	3.0	6.5	12	23	12	12	23	
AMERICA SUN	WNEJ	29	39.3 N	156.3 E	12	30	45	2 NM	93	1016.6	6.0	13.3	5	10	31	8	16.5	
PRESIDENT TYLER	WEZM	29	48.3 N	161.5 E	12	30	M 50	5 NM	02	0986.0	2.7	3.3	7	28	30	9	41	
NEPTUNE DIAMOND	9VYT	29	51.0 N	169.9 E	21	20	M 45	10 NM	60	0975.0	2.2	1.4	3	1.5	20	11	16.5	
PRESIDENT TYLER	WEZM	30	46.8 N	163.6 E	00	30	M 65	5 NM	22	0996.0	0.5	4.5	8	41	30	12	59	
SEA LAND VOYAGER	KHRK	30	43.7 N	164.9 W	00	27	M 43	5 NM	02	0996.3	10.0	10.0	4	8	26	12	16.5	
LIONS GATE BRIDGE	JCLL	30	53.0 N	140.7 W	06	14	M 42	5 NM	00	0989.4	6.5	11.0						
VAN ENTERPRISE	H8JO	30	53.7 N	141.9 W	06	14	M 53	5 NM	65	0986.7	6.0	10.0						
NEPTUNE DIAMOND	9VYT	30	49.6 N	166.6 E	06	25	M 46	2 NM	64	0981.0	1.2		5	3	27	11	18	
ARCO ALASKA	KSBK	30	59.8 N	145.5 W	13	10	M 54	2 NM	02	0977.0	4.4	7.0						
ARCO ANCHORAGE	WCIQ	30	58.5 N	144.0 W	18	10	45	2 NM	62	0964.0	6.6	6.6	7	11.5	12	10	21	
CHEVRON MISSISSIPPI	WXRR	30	54.0 N	149.7 W	18	23	43	2 NM	02	0966.8	3.5	6.2	6	10	23	6	16.5	
ARCO SAG RIVER	WLDF	30	47.3 N	131.2 W	18	24	M 30	2 NM	62	0999.0	11.5	9.0	6	13	24	10	32.5	
ARCO CALIFORNIA	WMCV	30	58.9 N	144.0 W	18	13	M 55	1 NM	10	0967.0	5.6	6.7	2	6.5	12	6	16.5	
PERENNIAL ACE	HOMQ	30	54.2 N	154.9 W	21	27	M 56	1 NM	16	0969.0	3.0	6.0	1	11.5	27	>13	26	
ENVIRONMENTAL BUOYS																		
46001		10	56.0N	148.0W	16	16	M29			962.1	7.7	6.8	5	20				
46002		14	42.5N	130.0W	06	29	M50			974.9	8.5	15.2	5	20				
46002		26	42.5N	130.0W	17	35	M34			1006.2	10.2	13.4	5	21				
46003		06	52.0N	156.0W	22	14	M46			993.1	6.0	8.2						
46003		07	52.0N	156.0W	00	15	M46			989.0	6.3	8.2						
46003		10	52.0N	156.0W	15	29	M41			969.3	5.9	7.9						
46003		25	52.0N	156.0W	03	26	M41			1012.2	5.4	7.2						
46003		30	52.0N	156.0W	14	27	M46			976.8	3.0	6.8						
46004		10	51.0N	136.0W	22	16	M42			974.7	11.0	9.8	4	17				
46005		26	46.0N	131.0W	07	32	M48			1003.0	8.0	13.1	4	15				
46010		14	46.2N	124.2W	12	16	M46			973.0	10.5	13.2	4	17				
46010		15	46.2N	124.2W	20	16	M48			983.4	11.8	13.2	2	08				

Vessel	Nationality	Date	Position of Ship		Time	Wind		Visibility	Present Weather	Pressure	Temperature °C		Sea Waves*		Swell Waves		
			Lat. deg.	Long. deg.	GMT	Dir. 10°	Speed kt.	n. m.	code	mb.	Air	Sea	Period sec.	Height ft.	Dir. 10°	Period sec.*	Height ft.
NORTH PACIFIC OCEAN		DEC.															
PERENNIAL ACE	HOMG	1	54.3 N	154.2 W	00	27	N 52	5 NM	26	0972.5	4.0	6.5	1	13	27	>13	26
ORIENTAL EXECUTIVE	DSAN	1	48.0 N	156.5 E	00	32	N 44	5 NM	02	1007.0	3.0						
ORIENTAL SOVEREIGN	ABUH	1	52.5 N	145.3 W	00	25	N 53	5 NM	03	0981.1	16.0	7.0	10	11.5	24	9	8
CHEVRON MISSISSIPPI	WXBR	1	53.8 N	148.5 W	00	25	50	5 NM	50	0975.6	2.8	5.5	5	8	24	7	19.5
PRESIDENT TYLER	WEZH	1	45.5 N	160.9 E	00	29	N 60	5 NM	22	1006.9	1.0	5.0	6	24.5	30	9	59
VAN ENTERPRISE	HBJO	1	52.8 N	144.1 W	00	26	N 55	1 NM	70	0981.0	5.0	9.0					
JAPAN APOLLO	JKZL	1	49.8 N	131.2 W	00	24	N 41	2 NM	62	0992.5	11.0	13.0	5	8	24	8	11.5
MALLORY LYKES	KLPN	1	17.2 N	120.0 E	00	03	19	10 NM	01	1012.9	26.7	26.7	2	3	36	6	49
LIONS GATE BRIDGE	JCLL	1	54.4 N	149.0 W	06	25	N 50	2 NM	82	0976.0	5.0		7	28	27	9	29.5
PRINCE WILLIAM SOUND	WSDX	1	44.4 N	129.5 W	06	27	N 45	5 NM	03	1017.8	12.5	13.0	3	6.5	27	9	8
PRESIDENT TAFT	WLDT	1	52.0 N	174.0 W	06	27	42	5 NM	02	0996.0	7.2	8.9	3	6.5	29	6	16.5
NEPTUNE DIAMOND	9HYT	1	45.5 N	165.6 E	06	28	N 38	5 NM	02	1018.8	1.5		8	10	28	9	32.5
SEALAND INNOVATOR	WGKF	1	39.2 N	175.5 E	12	28	N 44	10 NM	02	1018.2	12.0	14.0			28		
GREAT LAND	WFDP	1	57.2 N	145.3 W	12	24	N 52	2 NM	22	0972.0	3.9	8.3	-		24		42.5
NEWARK	WNDO	1	56.3 N	143.4 W	12	24	N 45	10 NM	01	0978.2	5.0	8.3	4	6.5	26	7	19.5
CHESNUT HILL	WWFX	1	21.0 N	126.6 E	18	03	50	5 NM	00	1020.5	21.7	25.6			XX		29.5
PORTLAND	WNDF	1	56.0 N	147.0 W	18	26	N 25	5 NM	50	0972.5	2.8	10.0	5	32.5			
EASTERN VENTURE	JGWT	1	51.7 N	141.2 W	18	25	40	5 NM	02	0994.0	5.5	8.5			05	6	36.5
PRINCE WILLIAM SOUND	WSDX	2	47.3 N	131.8 W	00	23	N 50	2 NM	21	1001.0	11.0	12.5	3	8	25	8	16.5
PACBARON	A8YI	2	38.9 N	164.8 E	00	09	N 42	.25 NM	53	1000.0	10.0	16.0	5	8	08	7	16.5
CHESNUT HILL	WWFX	2	20.3 N	125.2 E	06	02	55	2 NM	11	1020.8	20.0	26.7	XX		36	7	41
PORTLAND	WNDF	2	56.2 N	142.7 W	06	26	N 35	10 NM	01	0989.0	2.2	5.8	8	32.5	XX		
PACIFIC VENTURE	HOVS	2	42.3 N	149.8 W	12	20	N 42	.5 NM	25	1005.0	11.0	8.0	7	11.5	20	7	14.5
SEALAND PATRIOT	KHRF	2	35.6 N	150.6 E	12	29	N 42	10 NM	01	0996.5	15.0	16.0	3	24.5	26	>13	19.5
PRESIDENT TYLER	WEZH	2	41.7 N	147.1 E	12	05	N 42	1 NM	71	1003.2	0.5	6.7	7	23	04	8	29.5
SARGODHA	OUIU	2	37.2 N	154.1 E	18	27	N 64	5 NM	02	0997.0	10.0	14.0	8	23			
SARGODHA	OUIU	3	37.1 N	156.2 E	00	29	N 52	2 NM	01	1005.5	11.0	14.0	9	23			
ARCO ALASKA	WSBK	3	57.2 N	141.6 W	00	14	N 60	5 NM	02	0990.0	7.2	6.1	8	23	XX		
SEALAND PATRIOT	KHRF	3	35.2 N	148.5 E	00	29	N 42	10 NM	01	1015.0	13.0	17.0	4	19.5	>13	23	
CHIBA	WMGN	3	41.7 N	154.3 E	00	36	N 55	1 NM	62	0997.5	5.0	11.0	3	41	36	9	46
MORILOIL	WMTO	3	52.4 N	131.6 W	12	14	N 47	10 NM	02	1004.4	6.6	10.8	7	11.5			
PRINCE WILLIAM SOUND	WSDX	3	54.8 N	136.7 W	12	14	N 50	10 NM	02	0999.0	7.5	11.1	3	6.5	27	8	8
ARCO ANCHORAGE	WCIO	3	48.6 N	132.7 W	12	13	50	7 NM	02	0995.0	7.0	10.0	8	13	13	6	13
CHEVRON CALIFORNIA	WCGN	3	56.6 N	138.9 W	18	23	45	2 NM	40	0989.5	8.3	7.8	6	16.5	13	6	23
ADRIAN MAERSK	OYIT	3	42.5 N	152.0 W	18	30	44	5 NM	03	0996.5	9.3	12.0		28	30		26
EXXON HOUSTON	KHPA	3	55.9 N	140.6 W	18	15	40	5 NM	02	0992.1	8.5	8.7	5	3	15	11	32.5
GLACIER BAY	KACF	3	56.6 N	140.2 W	18	13	45	5 NM	02	0982.0	8.3	6.7	5	11.5	13	< 6	16.5
PRESIDENT JEFFERSON	WPGE	3	49.9 N	172.4 W	18	27	45	5 NM	63	0999.3	6.7	6.7	12	14.5	13	< 6	13
PORTLAND	WNDF	3	51.4 N	132.7 W	18	10	N 40	2 NM	01	0986.0	6.7	8.6	5	36	XX		
ARCO FAIRBANKS	WGWB	3	55.7 N	138.6 W	18	14	N 47	5 NM	02	0985.0	6.6	8.8	4	11.5	15	9	19.5
RED ARROW	SLTT	3	48.2 N	133.5 W	18	27	N 43	10 NM	53	1007.5	8.0	11.0	5	19.5	27	10	13
ORIENTAL COMMANDER	9VWU	4	39.7 N	146.8 W	00	27	N 45	2 NM	17	1003.0	14.0	12.0	6	16.5	27	6	16.5
MORILOIL	WMTO	4	51.2 N	130.4 W	00	25	N 48	10 NM	02	1002.4	7.9	10.0	7	11.5	25	8	46
PHILADELPHIA	WJGO	4	50.9 N	129.3 W	00	24	N 45	10 NM	02	1006.0	8.9	11.7					
PRINCE WILLIAM SOUND	WSDX	4	57.4 N	142.0 W	00	26	N 60	5 NM	72	0985.5	2.0	10.0	3	10	27	8	16.5
CHEVRON MISSISSIPPI	WXBR	4	43.9 N	148.2 W	00	35	50	2 NM	01	0992.9	6.6	8.9	5	6.5	29	7	21
PACBARON	A8YI	4	41.8 N	177.6 E	00	26	N 50	1 NM	01	0995.0	10.0	15.0	5	13	26	9	21
GLACIER BAY	KACF	4	56.9 N	141.5 W	00	27	45	5 NM	01	0989.0	1.1	5.6	5	11.5	14	6	16.5
ADRIAN MAERSK	OYIT	4	42.0 N	149.2 W	00	27	42	10 NM	02	1002.9	11.0	12.0		24.5	28		19.5
CHEVRON CALIFORNIA	WCGN	4	56.7 N	141.0 W	00	24	60	.5 NM	73	0982.1	2.4	7.2	2	10	19	9	23
EXXON HOUSTON	KHPA	4	53.7 N	138.6 W	18	06	45	2 NM	02	0999.7	7.5	8.7	4	6.5	06	11	21
WESTWARD VENTURE	KHJF	5	55.2 N	138.9 W	06	09	N 42	2 NM	51	0967.0	8.2	8.8	6	14.5	09	9	16.5
PRESIDENT WILSON	WNPD	5	44.3 N	161.4 W	00	01	41	10 NM	14	0999.6	8.3	10.0	4	16.5	01	>13	18
OCEAN BRIDGE	7LYR	5	53.5 N	141.9 W	00	33	N 50	> 25 NM	09	0970.0	10.0	8.0	8	11.5	33	8	11.5
ARCO ALASKA	WSPK	5	50.8 N	176.1 W	06	28	N 42	5 NM	62	0982.0	6.7	7.8					
MAUNALEI	KSVE	5	48.0 N	125.1 W	12	17	N 47	5 NM	13	0987.5	12.2	10.6	9	23	17	9	23
PERENNIAL ACE	HOMG	6	48.3 N	159.8 E	03	21	N 43	5 NM	01	1000.0	5.0	8.0	1	6.5	20	< 6	10
SANSINENA II	WSIN	6	58.5 N	150.1 W	12	13	42	10 NM	00	0983.7	1.1	4.4			11	< 6	10
VAN ENTERPRISE	HBJO	6	52.7 N	172.0 E	12	16	N 42	5 NM	03	1017.0	5.0	6.0					
SEALAND EXPLORER	WGJF	6	35.2 N	174.6 E	23	15	N 54	1 NM	53	1011.9	19.0	19.0	5	13	14	8	26
JAPAN CAOBO	3MKV	6	34.6 N	155.6 W	00	36	35	10 NM	60	1026.0	13.0	17.0	6	13	35	9	32.5
JARVIS WMEC 725	NAOD	6	58.0 N	174.2 W	06	16	N 45	2 NM	61	0994.5	4.1	4.5	10	14.5	00		0
RUTH LYKES	KGMB	8	36.8 N	157.4 E	00	05	41	10 NM	02	1005.6	14.4	15.5	6	8	04	8	13
SEALAND EXPLORER	WGJF	8	35.5 N	156.0 E	18	25	N 45	5 NM	03	0990.2	15.0	19.0					
SAN DIEGO	WSVR	9	45.1 N	130.3 W	06	27	45	10 NM	01	0993.0	9.4	10.0	4	6.5	XX		
SMUNWIND	ELTQ	9	46.2 N	166.7 E	06	08	N 48	5 NM	02	0999.5	4.5	6.0	12	13	08	12	10
FORTUNSTAR	5LUW	9	47.1 N	177.8 E	12	11	N 50	5 NM	03	1002.0	5.0	6.0					
SEA LAND VOYAGER	KHRK	9	37.2 N	176.3 W	18	30	N 45	10 NM	64	1008.0	13.1	16.0	5	5	28	13	10
SOUTH LIGHT	SMPK	10	49.2 N	176.0 W	00	09	N 41	.25 NM	49	0993.5	4.0	9.0	4	5	09	< 6	8
AMERICAN AQUARIUS	WYBI	10	41.7 N	177.8 E	06	26	50	5 NM	15	0999.9	11.2	11.5	8	16.5	25	13	19.5
SEALAND INNOVATOR	WGKF	10	43.7 N	174.9 W	06	22	N 45	5 NM	81	0997.2	10.5	11.0	2	5	22	7	8
SEALAND DEFENDER	KGJB	10	38.7 N	177.4 E	06	27	N 43	10 NM	02	1007.4	14.5	15.0	8	23	27	9	29.5
SACHEMCHANT	CHCB	11	54.2 N	177.2 W	00	07	48	.5 NM	21	1009.5	4.0	5.0	3	1.5	07	7	8
VAN ENTERPRISE	HBJO	12	34.7 N	179.0 E	12	26	N 42	5 NM	05	1010.0	13.0	20.0					
SEALAND MARINER	KGJF	12	43.0 N	175.3 E	18	29	N 45	10 NM	03	1011.8	5.0	1.0	5	6.5	29	13	23
EXXON NEW ORLEANS	WNOM	12	52.2 N	136.4 W	18	14	N 46	10 NM	02	1006.5	10.0	8.3	6	19.5			
WESER EXPRESS	DLDE	13	40.0 N	170.8 W	00	26	44	10 NM	01	1002.5	11.8	12.6	12	14.5	26	>13	16.5
JOHN LYKES	KIHD	13	31.6 N	159.1 E	00	27	45	10 NM	32	1016.5	16.7	23.3	1	13	29	< 6	13
SEALAND DEFENDER	KGJB	13	30.8 N	147.5 E	12	28	N 42	10 NM	81	1006.0	8.5	16.0	7	16.5	28	9	23
HARUNA MARU	JJRQ	13	35.7 N	167.2 W	12	25	N 41	5 NM	02	1010.5	13.5	16.5	5	10	32	6	19.5
MOBILE MERIDIAN	KGSM	13	48.4 N	177.1 W	14	09	N 50	5 NM	53	1005.1	7.7	8.9	5	8	09	< 6	14.5
GOLDEN GATE BRIDGE	JPZD	13	46.5 N	134.2 W	18	25	N 47	5 NM	07	0990.0	9.0	14.0	6	14.5	25	8	14.5
OGDEN SENEGAL	A8FO	13	37.0 N	157.9 E	18	27	N 41	10 NM	07	1001.4	11.5	18.0	6	10	27	9	14.5
EXXON PHILADELPHIA	WNFJ	13	41.5 N	126.0 W	18	20	N 45	5 NM	62	1009.8	14.0	12.8	5	5	20	6	6.5
PRESIDENT MC KINLEY	WYFZ	14	37.0 N	153.0 E	00	27	45	5 NM	53	1006.0	11.1	18.3	8	6.5	29	12	19.5
EXXON NEW ORLEANS	WNOM	14	48.2 N	132.9 W	00	29	N 70	5 NM	01	0991.0	9.5	8.8	5	16.5			
PHILADELPHIA	WJGO	14	51.5 N	131.0 W	00	09	N 45	2 NM	55	0987.5	7.0	11.0	6	11.5	10	10	14.5
GOLDEN GATE BRIDGE	JPZD	14	47.8 N	135.7 W	00	25	N 55	5 NM	07	0994.5	7.5	13.0	5	14.5	26	9	14.5
KEYSTONE CANYON	WSFK	14	48.5 N	132.2 W	00	23	50	1 NM	45	0998.8	7.8	10.0	10	29.5			
VAN CONQUEROR	A8IB	14	49.5 N	171.9 W	06	25	N 50	10 NM	60	0996.0	7.0	12.0					
MING STAR	BLMV	15	36.5 N	176.8 W	06	30	N 25	5 NM	02	1011.5	14.8	17.0			29	13	37.5
PORTUGAL MARU	JJDJ	15	45.0 N	131.0 W	09	26	N 49	5 NM	02	1001.0	10.5	12.0			28	6	23
MORNING ARROW	3ENE	15	36.4 N	152.5 W	12	18	N 45	.25 NM	07	0988.5	10.0	13.0	6	13	18	7	16.5
WESER EXPRESS	DLDE	15	39.4 N	146.2 W	18	17	52	5 NM	64	0990.5	14.0	12.5	8	16.5	XX		16.5
GLACIER BAY	KACF	15	35.3 N	154.8 W	18	27	50	5 NM	81	0995.0	12.8	13.9	4	10	28	7	16.5
GLACIER BAY	KACF	16	36.4 N	153.5 W	00	25	50	5 NM	81	0994.0	12.8	13.9	4	13	28	7	19.5
PORTUGAL MARU	JJDJ	16	48.9 N	136.2 W	09	13	N 50	10 NM	02	0990.5	10.5	9.0	3	6.5	13	6	29.5
SHERMAN WMEC 720	NMMJ	16	53.3 N	144.6 W	12	11	50	2 NM	61	0972.0	5.0	6.0	13	23			
NEWARK	WNDO	16	54.8 N	140.7 W	12	15	N 42	10 NM	02	0987.0	5.6	6.7	4	23			
PORTLAND	WNDF	16	55.4 N	144.7 W	12	12	N 47	2 NM	52	0980.0	4.4	5.5	6	19.5	12	6	13
ARCO FAIRBANKS	WGWB	16	54.8 N	139.3 W	18	12	N 50	2 NM	02	0983.5	11.0	9.1			15	7	16.5
GREAT LAND	WFDP	16	56.3 N	148.5 W	18	09	N 56	.5 NM	62	0973.8	4.4	8.3	5	10	10	9	19.5
FORTUNSTAR	5LUW	16	47.4 N	131.7 W	18	16	N 46	1 NM	59	1004.5	10.0	10.0					
SMUNWIND	ELTQ	16	48.0 N	149.2 W	18	20	N 41	10 NM	02	0964.4	6.0	8.0	8	10	20	11	14.5
SKAUGRAN	LMUK	16	52.1 N	135.2 W	18	15	N 50	200 YD	46	1009.9	9.5	10.0	8	6.5	16	11	19.5
EXXON SAN FRANCISCO	KAAC	16	53.1 N	137.5 W	18	18	N 45	1 NM	02	0988.1	7.7	9.5	5	10	18	9	13

Vessel	Nationality	Date	Position of Ship		Time GMT	Wind		Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C.		Sea Waves+		Swell Waves		
			Lat. deg.	Long. deg.		Dir. 10°	Speed kt.				Air	Sea	Period sec.	Height ft.	Dir. 10°	Period sec.*	Height ft.
NORTH PACIFIC OCEAN		DEC.															
TONSINA	KJDG	16	51.9 N	136.4 W	18	13	M 45	5 NM	07	0990.7	8.9	6.7	5	29.5	13	7	26
SEA LAND VOYAGER	KHRK	16	34.9 N	159.2 E	18	32	M 50	2 NM	27	1016.0	11.0	18.0	5	16.5	30	6	24.5
SEA LAND VOYAGER	KHRK	17	34.8 N	156.0 E	00	32	M 50	10 NM	25	1019.1	19.3	18.0	5	13	30	11	24.5
SHUNWIND	ELIQ	17	48.8 N	148.8 W	00	13	M 41	10 NM	01	0964.4	6.4	8.0	10	10	18	10	10
FORTUNSTAR	SLUW	17	47.3 N	130.9 W	00	14	M 44	.5 NM	59	1002.5	10.0	10.0					
OVERSEAS JUNEAU	WWND	17	48.7 N	131.1 W	00	14	45	1 NM	07	0995.4	8.8	8.8	6	18	15	9	23
WALOP	DZNP	17	29.9 N	177.7 W	12	29	M 42	5 NM	01	1000.5	20.0	19.0	5	10	29	8	13
ASIA HERON	ABDD	17	33.2 N	171.6 E	12	31	M 52	2 NM	02	1009.5	14.0	23.0					
EASTERN FRIENDSHIP	HBLR	17	44.9 N	139.7 W	12	26	M 43	2 NM	05	0998.2	7.0	11.0	9	8	26	9	8
TONSINA	KJDG	17	50.4 N	134.6 W	18	12	40	5 NM	07	0987.8	10.0	7.2	5	13	14	8	32.5
MOBILE MERIDIAN	KGSM	17	50.4 N	128.9 W	18	14	M 52	10 NM	02	1007.8	10.6	10.6	6	16.5	13	7	13
GREAT LAND	WFDP	17	54.7 N	137.8 W	18	11	55	.5 NM	62	0982.9	10.0	8.9	4	10	12	11	23
R T ALASKA	WFQE	17	50.2 N	134.5 W	18	15	M 45	1 NM	63	0987.2	10.0	8.9	5	13	18	7	19.5
ARCO FAIRBANKS	WGWB	17	53.5 N	136.7 W	18	13	M 50	2 NM	02	0982.0	8.9	6.6			13	8	18
PORTLAND	WNDF	17	53.1 N	137.8 W	18	14	M 45	2 NM	53	0978.8	6.5	5.8	5	32.5	16	< 6	19.5
PORTLAND	WNDF	18	52.8 N	137.2 W	00	16	M 35	2 NM	53	0985.0	7.5	7.8	6	32.5	18	6	32.5
GREAT LAND	WFDP	18	53.9 N	135.6 W	00	17	45	2 NM	63	0986.6	7.5	8.9	4	10	17	9	32.5
PRESIDENT JOHNSON	WWHS	18	48.7 N	129.1 W	00	13	48	2 NM	52	0990.8	8.9	9.4	4	18	XX		19.5
OVERSEAS JUNEAU	WWND	18	54.2 N	136.9 W	00	14	45	2 NM	07	0988.6	7.7	6.7	6	13	17	8	19.5
R T ALASKA	WFQE	18	52.6 N	137.0 W	06	22	M 42	10 NM	81	0983.8	7.8	5.6	5	16.5	23	7	24.5
MOBILE MERIDIAN	KGSM	18	53.6 N	133.2 W	06	24	M 72	5 NM	65	0984.1	6.1	10.0	5	13	13	7	23
SEALAND PATRIOT	KHRF	18	39.0 N	161.4 E	12	28	M 45	10 NM	02	1008.0	11.8	12.0	3	19.5	28	>13	16.5
ALEUTIAN DEVELOPER	WIPL	18	55.8 N	159.0 W	12	34	50	10 NM	85	0997.0	0.0	5.6	5	13	34	6	13
PRESIDENT TYLER	WEZM	19	37.7 N	163.0 E	00	29	M 40	5 NM	27	1014.0	9.0	15.0	5	24.5	30	9	36
TOYOTA MARU 12	JBJO	19	48.0 N	137.5 W	09	31	M 42	10 NM	03	0984.5	7.5	9.5					
SEALAND LIBERATOR	KHRP	19	50.0 N	137.0 W	12	31	M 41	10 NM	02	0979.1	8.0	7.0	5	32.8			
PRESIDENT MC KINLEY	WWFZ	19	37.0 N	143.0 W	18	26	45	10 NM	81	1002.8	14.4	13.9	7	13	29	13	24.5
EXXON PHILADELPHIA	WNFJ	19	50.5 N	134.2 W	18	31	M 60	1 NM	00	0984.8	-	8.8	4	10	31	7	13
PERENNIAL ACE	HOMG	19	44.4 N	166.0 W	21	16	M 42	2 NM	60	0993.5	8.0	8.0	13	8	15	< 6	6.5
VIENNA WOODS	SLOI	19	46.3 N	169.5 W	23	14	M 55	.25 NM	92	0987.0	6.0	5.0	5	8	14		
AUSTRAL ENDURANCE	KIRF	20	35.7 N	144.5 E	06	29	45	10 NM	01	1000.0	13.4	20.0	4	5	25	9	10
ARCTIC TOKYO	SLJT	20	38.7 N	144.0 E	12	29	M 38	5 NM	03	1008.0	5.0	7.0		19.5	29		32.5
OLGA TOPIC	ABEE	20	38.3 N	162.2 E	12	20	50	.25 NM	06	0989.0	17.0	16.0	10	29.5	00		0
ATLANTIC PIONEER	H3WN	20	41.5 N	171.9 E	18	20	M 45	2 NM	55	0985.5	14.0	13.0	7	23	20	7	23
AUSTRAL ENDURANCE	KIRF	21	37.2 N	150.7 E	00	30	50	5 NM	02	1012.0	9.4	14.4	4	10	30	10	13
ALVA MAERSK	OZSD	21	39.3 N	176.7 E	00	19	45	2 NM	02	0999.1	16.0	13.0	10	14.5			
ORIENTAL SOVEREIGN	ABUH	21	45.3 N	165.6 E	00	28	M 44	2 NM	18	0967.6	5.0	6.5	1	14.5	28	9	13
PACIFIC VENTURE	SLKH	21	42.4 N	165.1 E	00	28	M 50	5 NM	10	0983.5	7.0	8.0	12	23			
KAUAI	WSRH	21	33.3 N	135.9 W	02	01	30	10 NM	02	1026.1	15.0	19.4	7	11.5	35	9	39
SEALAND DEVELOPER	KHRH	21	51.4 N	166.7 E	06	35	M 60	.25 NM	72	0950.0	2.0	5.0	10	16.5	35	6	29.5
DIANA	D5JV	21	54.3 N	177.3 W	09	13	M 51	50 YD		0962.0	2.0	5.0					
PRESIDENT TYLER	WEZM	21	41.2 N	171.3 W	12	16	M 48	2 NM	60	0994.0	12.2	10.0	7	21	18	9	39
PRESIDENT TAFT	WLOT	21	46.9 N	179.0 W	18	24	50	5 NM	02	0967.5	4.4	5.5	6	16.5	24	11	32.5
NEPTUNE DIAMOND	9VYT	21	40.9 N	170.4 E	18	29	M 45	5 NM	02	0996.0	4.2						
ATLANTIC PIONEER	H3WN	21	42.9 N	179.2 E	18	27	M 47	.5 NM	05	0984.5	6.5	12.0	8	19.5	27	8	19.5
SILVER PHOENIX	D5NW	21	54.2 N	163.7 W	21	15	M 43	5 NM	23	0983.6	5.5	4.0	21	24.5	15	6	10
NEPTUNE DIAMOND	9VYT	22	40.9 N	173.0 E	00	30	M 44	2 NM	89	0998.2	4.0	17.0	4	6.5	29	< 6	10
PACIFIC VENTURE	SLKH	22	41.5 N	171.7 E	00	31	M 45	5 NM	15	0998.0	4.0	13.5	12	23			
PRESIDENT TAFT	WLOT	22	47.2 N	176.9 W	00	24	50	5 NM	83	0967.5	2.8	5.5	6	16.5	24	11	32.5
PRESIDENT TYLER	WEZM	22	41.9 N	166.2 W	00	23	M 35	1 NM	60	0994.0	12.2	8.9	9	19.5	20	12	34.5
SEALAND DEVELOPER	KHRH	22	48.4 N	160.3 E	00	31	M 47	10 NM	15	0997.0	1.0	3.0	12	19.5			
SKAUGRAN	LHUK	22	55.0 N	178.6 W	00	16	M 45	2 NM	26	0956.0	2.5						
ATLANTIC PIONEER	H3WN	22	43.6 N	176.9 W	06	27	M 47	50 YD	11	0986.5	4.0	9.0	8	19.5	27	8	19.5
DIANA	D5JV	22	52.6 N	172.0 E	21	31	M 41	.5 NM	02	0981.0	2.0	5.0	10	18	31	>13	16.5
SEALAND LIBERATOR	KHRP	23	47.2 N	166.1 W	00	22	M 33	10 NM	27	0988.5	6.5	5.0	8	32.5	27	8	
SKAUGRAN	LHUK	23	53.4 N	173.7 E	00	31	M 45	5 NM	84	0984.0	2.5	6.2	10	8	31	12	29.5
DIENA	DXFU	24	41.8 N	146.0 E	00	26	M 41	> 25 NM	22	0999.7	7.4	6.0	8	10			
SEALAND LIBERATOR	KHRP	24	44.4 N	172.6 W	00	28	M 40	10 NM	03	1013.2	6.5	5.0	5	19.5	31	7	32.5
MOBILE MERIDIAN	KGSM	24	48.6 N	127.8 W	06	14	M 45	5 NM	63	1010.8	6.3	8.3	4	8	22	9	10
SKAUGRAN	LHUK	24	54.0 N	160.7 E	18	25	M 43	2 NM	02	0997.5	0.5						
SOUTH EXPRESS	A8WR	24	53.9 N	155.4 W	18	24	M 48	5 NM	21	1000.0	4.0	6.0	8	14.5	24	8	14.5
EASTERN FRIENDSHIP	HBLR	25	52.9 N	172.2 E	00	32	M 43	1 NM	46	0989.0	5.0	5.0	14	8	18	< 6	8
SKAUGRAN	LHUK	25	49.4 N	158.5 E	06	29	M 57	2 NM	80	0980.0	2.0						
MING MOON	BLMO	25	37.3 N	158.6 W	11	03	M 42	5 NM	02	1014.0	11.0	12.5					
SOUTH EXPRESS	A8WR	25	54.0 N	162.0 W	18	27	M 48	5 NM	03	1022.0	5.0	4.0	8	16.5	27	8	16.5
SILVER PHOENIX	D5NW	25	48.0 N	156.2 E	23	25	M 42	10 NM	01	1008.8	- 1.0	1.0	20	24.5	25	8	10
DIANA	D5JV	25	48.3 N	155.1 E	23	24	M 41	1 NM	88	1007.0	- 1.0	3.0	9	11.5	24	8	13
SOUTH EXPRESS	A8WR	26	54.1 N	164.6 W	00	27	M 48	2 NM	03	1028.0	5.0	5.0	8	16.5	27	8	14.5
SEALAND EXPLORER	WGJF	26	39.4 N	175.7 W	12	16	M 42	5 NM	61	1015.5	10.5	15.0			18	10	14.5
PACIFIC VENTURE	SLKH	27	41.5 N	157.7 W	00	05	M 45	2 NM	50	1014.0	6.5	11.0	7	32.5			
NEPTUNE AMBER	S6CY	27	54.0 N	153.1 W	00	31	M 42	5 NM	01	1019.5	4.3	5.0	6	8	32	8	10
SOUTH EXPRESS	A8WR	28	53.4 N	172.3 W	18	28	M 50	5 NM	02	1019.0	3.0	2.0	8	14.5	18	8	14.5
SOUTH EXPRESS	A8WR	29	52.2 N	170.0 E	06	23	M 52	2 NM	03	1017.0	1.0	2.0	10	23	23	9	23
UNITED SPIRIT	5MKM	29	53.6 N	179.4 E	12	19	M 44	2 NM	02	1024.5	4.0	5.0	8	11.5	19	12	14.5
NEPTUNE AMBER	S6CY	29	53.3 N	175.6 E	18	24	M 41	10 NM	03	1023.5	3.0						
SUNNY PIONEER	H3SY	30	46.3 N	159.5 E	12	25	M 44	2 NM	03	1001.0	4.0	1.0			XX		
DAFFODIL	H3AG	30	41.4 N	179.5 E	12	05	M 43	2 NM	03	1018.5	11.0	12.0	5	16.5	05	10	23
VAN CONQUEROR	A8TB	30	46.6 N	155.9 E	12	27	M 51	5 NM	63	0991.0	2.0	7.0					
UNITED SPIRIT	5MKM	30	54.5 N	170.5 E	18	18	M 41	5 NM	02	1008.8	1.0	5.0	8	11.5	22	9	11.5
PRESIDENT MC KINLEY	WWFZ	30	37.9 N	176.4 W	18	05	45	5 NM	50	1000.5	12.8	13.9	4	13	04	8	29.5
NEPTUNE AMBER	S6CY	30	51.3 N	166.5 E	18	18	M 50	1 NM	07	0997.5	4.0						
NEPTUNE AMBER	S6CY	31	50.8 N	164.7 E	00	21	M 52	.5 NM	67	0992.0	3.0	2.2	10	16.5	21	9	23
AMERICAN ASTRONAUT	WZJG	31	35.5 N	149.7 E	00	06	45	5 NM	60	1007.8	12.8	20.0	8	24.5	05	6	11.5
SEALAND FREEDOM	WGJW	31	49.5 N	162.0 E	00	25	55	2 NM	26	1001.5	2.0	3.0	7	36			
UNITED SPIRIT	5MKM	31	52.0 N	169.0 E	00	20	M 45	5 NM	02	0999.5	4.0	5.0	10	13	20	< 6	16.5
SOUTH EXPRESS	A8WR	31	54.7 N	160.1 E	06	28	M 48	2 NM	03	1008.0	- 2.0	0.0	10	23	28	9	23
WESER EXPRESS	DLDE	31	52.9 N	171.5 E	12	23	48	5 NM	86	1008.0	2.5	4.8					
AMERICA SUN	WNEJ	31	42.3 N	127.4 W	18	01	M 45	2 NM	82	1035.9	12.0	10.6	3	5	01	6	8
ENVIRONMENTAL BUOYS																	
46003		05	52.0N	156.0W	16	30	Mk2			998.7	-2.7	5.8					
46003		06	52.0N	156.0W	12	30	Mk1			1002.1	-1.8	5.8					
46004		05	51.0N	136.0W	00	26	Mk3			968.8	6.2	8.2	5	16			
46004		16	51.0N	136.0W	15	14	Mk1			993.8	8.8	7.5	4	14			
46004		19	51.0N	136.0W	14	30	Mk2			979.5	5.5	7.4	4	11			
46005		03	46.0N	131.0W	09	23	Mk1			1001.1	10.6	12.5	4	11			
46005		04	46.0N	131.0W	22	23	M23			995.5	9.7	12.3	6	20			
46005		17	46.0N	131.0W	22	22	Mk5			990.5	9.5	11.6	4	13			
46006		04	40.7N	137.7W	20	23	Mk4			997.0	15.2	13.5	4	14			
46006		17	40.7N	137.0W	06	17	Mk5			990.8		13.1	4	13			
46006		20	40.7N	137.0W	12	31	M56			1000.8	8.4	12.8	4	17			
46010		05	46.2N	124.2W	08	18	M35			997.1	11.3	12.8	5	20			

+ Direction for sea waves same as wind direction
X Direction or period of waves indeterminate
M Measured wind

NOTE: The observations are selected from those with winds ≥ 35 kn or waves ≥ 25 ft from May through August (≥ 41 kn or ≥ 33 ft, September through April). In cases where a ship reported more than one observation a day with such values, the one with the highest wind-speed was selected.

U.S. Cooperative Ship Weather Reports

October, November and December 1981

SHIP NAME	VIA RADIO	VIA MAIL
ACADIA	92	
ADM WM M CALLAGHAN	30	87
AFRICAN DAWN	170	305
ALASKA STANDARD	26	94
ALERT	32	
ALLTRANS ENTERPRISE	42	96
AMERICA MARU	269	114
AMERICAN ALLIANCE	77	321
AMERICAN ARGOSY	93	257
AMERICAN CHARGER	1	25
AMERICAN HERITAGE	82	209
AMERICAN LARK	104	260
AMERICAN LEGION	67	262
AMERICAN RANGER	16	196
AMOCO CAIRO	49	
ANDERS MAERSK	99	137
ANTONIA JOHNSON	16	117
ARCO CALIFORNIA	193	261
ARCO PRUDHOE BAY	1	9
ARGONAUT	99	156
ARTHUR MAERSK	89	139
ASIA BRAVERY	28	167
ASIA INDUSTRY	92	29
ATLANTIC BRIDGE	137	
ATLANTIDE	2	
AUSTRAL ENSIGN	44	717
AUSTRAL LIGHTNING	115	238
AUSTRAL RAINBOW	125	711
B T ALASKA	34	587
BALT BUTTE	30	315
BARRER TAFF	61	87
BARWA	17	69
BAYANO	728	353
BEDELIOT	53	159
BLUEBIRD	172	27
BOSTON	57	224
BRILLIANT STAR	17	
BUNGA MELAWIS	47	
CALIFORNIAN	5	
CARNIVALE	65	77
CHAPMAN	104	182
CHARLOTTE MAERSK	25	18
CHANCT	33	24
CHEMHIRE	105	17
CHEVRON EURNARY		46
CHEVRON EDINBURGH	43	51
CHEVRON NAGASAKI		107
CHEVRON PERTH	36	189
CHI 182	5	
CHUN ON	69	93
CLARA MAERSK	85	77
COLOMBIA MARU	16	12
COLUMBUS LOUISIANA	117	
CONCORDIA SUN	16	42
CORAL ARCADIA	4	
COURAGEOUS WMEC 622	115	108
CRYSTAL STAR	64	95
DALLAS WMEC 716		83
DAVID C. IRWIN	30	46
DEFIANCE	7	11
DEL RIO	32	77
DELAWARE GETTY	49	222
DELTA CARTEE	52	146
DISCOVERER DSS	184	193
DOLLY TURMAN	26	49
DORTE	45	222
DURABLE	25	
EASTERN BRIDE	3	164
EASTERN MUSE	150	
EASTERN VENTURE	102	137
EL MEXICANO	15	
ENNA G	194	154
ESSO NASSAU	16	32
EURO-ASIA CONCORDE	69	7
EWER VICTORY	4	
EXPORT CHALLENGER	18	65
EXPORT PATRIOT	9	20
EXXON BOSTON	41	116
EXXON HOUSTON	44	75
EXXON NEW ORLEANS	70	59
EXXON SAN FRANCISCO	62	127
FESTIVALE	55	89
FORTALEZA	213	739
FORTUNESHIP	92	277
GALLEON ONYX	4	
GEMINI	15	
GEORGE L PARKHURST	2	
GLADIOLUS	4	17
GOLDEN ANNE	13	
GOLDEN ORCHID	43	
GRAND CARRIER	2	
GREEN RAMLET	127	
GREEN VALLEY	33	
GULF FARMER	18	27
GULFDEER	29	
HAFA ADAI	1	
HENJIN MOHAMC	5	77
HIRUNA MARU	333	226
HIRARA MARU	195	67
HOECH MERCHANT	12	
HOEGH ORCHID	1	
HOMSING ARROW	3	48
HOUSTON	16	144
IDAHO	26	
IRIS ISLAND		137
ITALY MARU	31	19
J R CREY	2	27
JALANTA	2	
JAMES LYKES	46	
JAPAN APOLLO	182	704
JEAN LYKES	26	
JOHN HENRY		174
JUTHLANDIA	64	129
KATHY	2	
KENAI	26	127
KOFUKU MARU	28	124
KOREAN LEADER	14	46
KUNGSHAMN	1	
LAKE ARROWHEAD	18	142
LAKE SHASTA	24	217
LASH PACIFICO	43	117
LETITIA LYKES	68	
LIONS GATE BRIDGE	187	178
LONG BEACH	54	311
LYNCH T-AGOR 7		133
MALLOW WLB 396	15	
MANUALII	98	261
MANZANARES	12	
MARCONA TRADER	10	
MARGARET LYKES	49	67
MARINE CHEMICAL TRANSP	40	233
MARITIME INVESTOR	29	
MASON LYKES	114	46
MAUI	176	352
MAYAGUEZ	94	426
MCKINNEY MAERSK	2	
MENESTHEUS	145	262
METEOR T-AGM 9	8	
MIDGETT WMEC 726	95	129
MING GALAXY	59	99
MING WINTER	2	
MOBIL ENGINEER	51	71
MOBILE	1	
MORILOIL	10	98

SHIP NAME	VIA RADIO	VIA MAIL
ACE ENTERPRISE	13	22
ADRIAN MAERSK	73	165
AFRICAN STARD	15	234
ALASKAN	160	271
ALEUTIAN DEVELOPER	107	104
ALLTRANS EXPRESS	60	252
AMERICA SUN	61	351
AMERICAN APOLLO	118	286
AMERICAN ARROW		57
AMERICAN CHIEFTAIN	31	70
AMERICAN HIGHWAY	57	
AMERICAN LEADER	132	311
AMERICAN LIBERTY	109	270
AMERICAN RELIANCE	47	194
ANCO DUKE	1	
ANNA MAERSK	115	226
AQUARIUS	1	
ARCO FAIRBANKS	161	335
ARCO SAP RIVER	46	137
ARIES	24	197
ARTHUR MIDDLETON	1	
ASIA FLAMINGO	47	
ASIAN EXPRESS	29	104
ATLANTIC EXPRESS	1	
AUGUSTE SCHULTE	7	
AUSTRAL ENTENTE	77	99
AUSTRAL MOON	110	195
AVILA	3	6
B T SAN DIEGO	74	346
BALTIMORE TRADER	75	286
BARRER TOKYO	55	114
BASSWOOD WLB180	6	
BAYNES	7	
BERKSHIRE	121	
BOUGAST DUB	155	316
BOUTWELL WMEC 719	41	179
BRUNO RANDF	33	60
BUNGA SEIPAKI	59	
CAMPBELL WMEC 37	64	
CECILIE MAERSK	32	66
CHARLES LYKES	116	200
CHASE WMEC 718	237	96
CHEMICAL VENTURE	61	
CHESNUT HILL	76	160
CHEVRON CALIFORNIA	107	219
CHEVRON KENTUCKY	244	
CHEVRON NORTH AMERICA		422
CHEVRON SOUTH AMERICA		343
CHIPA	78	21
CITRUS WLB302	74	
CLIFFORD MAERSK	35	50
COLOMBUS VENTURE	35	154
COMMON VENTURE	24	
CONFIDENCE WMEC 619	7	
CONNACOPIA	65	272
CRESSIDA	69	185
D ALBERTS	81	168
DANGOU ICE	224	
DAVID P REYNOLDS	703	560
DEL CAMPO	63	170
DEL SOL	15	15
DELAWARE II	715	279
DELTA SUD	8	48
DITTE SKOU	131	327
DON QUAN	7	23
DRUCILLA W	10	
E. HORNSEY WASSON	1	20
EASTERN DIAMOND		67
EASTERN RIVER	116	
EASTERN WORLD	80	67
EL PASO HOWARD RUYE	1	
ERNA OLDENDORFF	21	
ESSO PALM BEACH	19	359
EWER SPRING	17	132
EVERGREEN WAGU-295	145	78
EXPORT CHAMPION	0	18
EXXON BALTIMORE	10	24
EXXON CHESTER	7	14
EXXON HUNTINGTON	123	146
EXXON NEWARK	20	67
EXXON WASHINGTON	50	43
FPH MATAFENTI	1	
FORTUNSTAR	142	215
FRANCIS	1	
GALLEON TOURMALINE	43	
GEN HOYT S VANDENBERG		42
GEORGE M KELLER	39	166
GLOBAL FRONTIER	45	208
GOLDEN DAISY	19	27
GOLDEN RAY	11	
GREAT LAND	155	231
GREEN HARBOUR	16	
GUATALUPE	1	
GULF MERCHANT	35	143
GULFKNIGHT	4	
HARUSAN MARU	298	223
HANSA BAY	7	
HECA ASUSI		109
HOEGH ELITE	1	
HOEGH MERIT	6	2
HOEGH ORBIS	23	58
HOMSING BREEZE	59	251
HOWARD C VERPER	14	126
IMACHUS STAR	43	114
IRIS QUEEN	741	
ITAPUCA	24	
J T HIGGINS	2	230
JALAPAMINT	14	
JAMES M GILLISS	1	
JAPAN CARGO	17	236
JEFF DAVIS	16	28
JOHN LYKES	50	167
JUTLANDIA	1	
KATRINA	7	
KENNETH E HILL	30	124
KOREAN COMMANDER	7	
KOREAN PEARL	1	
KUROBE MARU	135	99
LAKE BERRYESSA	19	36
LAKE TAHOE	43	
LAUREL KLOUTZ	27	37
LENA MAERSK	240	
LLOYD CUIABA	10	
LOUISE	149	407
MAGALENA	211	
MANHATTAN	56	173
MANUKAI	189	428
MARCHEN MAERSK	67	118
MARCONA TRANSPORTER	58	362
MARIA RUBICON	63	48
MARITIME ACE	20	
MARITIME JUSTICE	34	6
MATHIESON	115	232
MAUMEE	3	0
MAYAPAN REEFER		166
MEADOWBROOK	56	155
MENINA ALICE	44	
MEXICO	3	
MILLER FREEMAN	248	327
MING GLORY	83	133
MOBIL ARGO	18	129
MOBIL LUBE	29	92
MOBILE MERIDIAN	102	230
MONMOUTH	15	97

SHIP NAME	VIA RADIO	VIA MAIL
MONCAGUA		80
MORTARIP	0	
MOUNTILLA	159	282
MOUNTAIN	146	192
MOUNTAIN IV	146	192
NEWENDO	17	38
NEMERIA LYKES	130	
NEW AMERICAN	120	314
NEW AMERICAN AQUARIUS	94	286
NEW AMERICAN ASTRONAUT	167	302
NEW AMERICAN CORSAIR	119	328
NEW AMERICAN INDEPENDENCE	1	
NEW AMERICAN LEGACY	112	200
NEW AMERICAN LYNX	91	322
NEW AMERICAN TRADER	187	518
NEW ANCO STAR	232	
NINTE JOHNSON	84	257
NEW ARCO ALASKA	81	173
NEW ARCO JUNEAU	162	240
NEW ARCTIC TOKYO		557
NEW ARILD MAERSK	34	70
NEW ASHLEY LYKES	70	72
NEW ASIA HERON	60	154
NEW ASIAN HIGHWAY	20	29
NEW ATLANTIC PIONEER	99	143
NEW AUSTIN	1	
NEW AUSTRAL ENVOY	97	165
NEW AUSTRAL PIONEER	57	74
NEW AXEL JOHNSON	19	21
NEW BACAB	0	
NEW BARNEY NASA	2	
NEW BARRER TONSBERG	37	93
NEW BAUNE	1	
NEW BEISHU MARU	125	45
NEW BIBB WMEC 31	8	
NEW BOWDOIN	148	159
NEW BRAZOS	140	158
NEW BUILDER	35	165
NEW CAPE WITTO		704
NEW CAPE WRIGHT		235
NEW CELESTINE	7	
NEW CHARLES PIGOTT	89	491
NEW CHASTINE MAERSK	24	92
NEW CHEVRON ANTWERP	7	729
NEW CHEVRON COLORADO	77	183
NEW CHEVRON LOUISIANA	2	16
NEW CHEVRON OKLEON	7	28
NEW CHEVRON TRANSPORTER	5	
NEW CHRISTIAN MAERSK	15	51
NEW CITY OF DUNDEE	2	
NEW CLOVER	120	250
NEW COLUMBIA	7	50
NEW CONALCO	100	94
NEW CONTRACT TRADER	2	
NEW CORONADO	9	1
NEW CRISTOBAL	32	111
NEW D L GEARY		271
NEW DART EUROPE	74	61
NEW DAVID PACKARD		160
NEW DEL MONTE	49	57
NEW DEL VALLE	34	62
NEW DELAWARE SUN	21	35
NEW DIAMOND PHOENIX	169	418
NEW DOCEANOPA	7	
NEW DONA CORAZON II		213
NEW DUANE	25	
NEW EAGLE	67	
NEW EASTERN FORTUNE	74	72
NEW EASTERN SUN	29	67
NEW EDGAR M QUEFAR	36	93
NEW ELIZABETH LYKES	53	107
NEW ESSO BAYONNE	17	
NEW ESSO SAINT JOHN	39	29
NEW EWER VALOR	71	63
NEW EXPORT BUYER	1	
NEW EXPORT FREEDOM	42	176
NEW EXXON BATON ROUGE	119	727
NEW EXXON GETTYSBURG	7	27
NEW EXXON LEXINGTON	34	64
NEW EXXON PHILADELPHIA	37	49
NEW FEDTRADE	112	100
NEW FORT HOSKINS	64	16
NEW FREDERICK LYKES	15	6
NEW GALLEON AQUAMARINE	22	
NEW GARDENIA	157	155
NEW GENTSTA	34	144
NEW GLACIER BAY	56	236
NEW GLOMAR PACIFIC	1	
NEW GOLDEN GATE BRIDGE	273	236
NEW GRACE	7	
NEW GREAT REPUBLIC	12	19
NEW GREEN HOPE	65	85
NEW GULF RANGER	27	108
NEW GULF TRADER	63	273
NEW HAGUE AGUS SALIM	9	58
NEW HENJIN INCHEON	12	
NEW HOEGH ELITE	1	
NEW HOEGH MASCOT		15
NEW HOEGH OPAL	16	9
NEW HOEGH PRIDE	6	31
NEW HOTARA MARU	277	109
NEW HUDSON T-AG 194	5	
NEW INTERMARINE VENTURE	1	
NEW ITALICA	43	149
NEW J LOUIS	162	259
NEW JADRAN	20	
NEW JAMES E O'BRIEN	1	113
NEW JAPAN AMBROSE	61	47
NEW JARVIS WMEC 725		93
NEW JOHN M MCCONE		525
NEW JOSEPH LYKES	48	80
NEW KASHU MARU	56	33
NEW KEIYU	33	167
NEW KNORR	108	236
NEW KOREAN JUPITER	29	99
NEW KOREAN PRIDE	194	
NEW LABRADOR CLIPPER	2	
NEW LAKE PALOUNDE	27	259
NEW LASH ITALIA	14	121
NEW LESLIE LYKES	43	192
NEW LILLODET	101	
NEW LONDON CRAFTSMAN	2	
NEW LUIGI GRIMALDI	11	
NEW MALLORY LYKES	118	358
NEW MANISTEE	150	372
NEW MANULEI	123	278
NEW MARCONA EXPORTER	173	541
NEW MARGARET JOHNSON	68	149
NEW MARIA G	67	185
NEW MARITIME HARMONY	26	
NEW MARJORIE LYKES	42	112
NEW MATSONIA	17	36
NEW MAYA	28	64
NEW MAYON	19	12
NEW MELVILLE	64	45
NEW MERCY	37	
NEW MIDAS ONEIN	30	68
NEW MING AUTUMN	1	
NEW MING STAR	22	86
NEW MOBIL COMET	1	
NEW MOBIL VENTURE	1	
NEW MOBILGAS	74	198
NEW NORBAT	90	

SHIP NAME	VIA RADIO	VIA MAIL
NEW NORBELLE LYKES	92	
NEW NORMAN LYKES	1	
NEW NYMPH	70	140
NEW ALBERT MAERSK	67	30
NEW ALLISON LYKES	34	
NEW ALVA MAERSK	52	164
NEW AMERICAN ACE	157	415
NEW AMERICAN ARCHER	179	203
NEW AMERICAN CHALLENGER	60	66
NEW AMERICAN EXPLORER	32	
NEW AMERICAN LANCER	139	325
NEW AMERICAN LEGEND	99	330
NEW AMERICAN RACER	32	
NEW AMERICANA	78	141
NEW ANCO TEMPLAR	232	
NEW ANTE TOPIC	18	24
NEW ARCO ANCHORAGE	186	264
NEW ARCO PRESTIDE	38	57
NEW ARECIBO	154	206
NEW ARNOLD MAERSK	49	76
NEW ASIA BEAUTY	20	
NEW ASIA HONESTY	16	
NEW ATHEL LEADER	118	73
NEW ATLANTIC RAINBOW	43	192
NEW AUSTRAL ENDURANCE	123	180
NEW AUSTRAL GLEN	1	
NEW AUSTRAL PURITAN	146	58
NEW AXEL MAERSK	95	170
NEW BARNES	2	
NEW BARRER PRIDE	82	86
NEW BARRANCA	286	298
NEW BAY	90	172
NEW BEL HUDSON	1	
NEW BLUE OCEAN	100	298
NEW BORINQUEN	105	246
NEW BRIGHT HOPE	99	
NEW BUNGA CHEMPAKA	1	
NEW CALIFORNIA RAINBOW	135	231
NEW CAPRICORN	90	88
NEW CHANCELLORSVILLE	34	9
NEW CHARLESTON	137	210
NEW CHAUVENET T AGS 29		282
NEW CHERRY VALLEY		125
NEW CHEVRON ARIZONA	69	212
NEW CHEVRON COPENHAGEN	18	238
NEW CHEVRON MISSISSIPPI	101	262
NEW CHEVRON PERMIS	1	90
NEW CHEVRON WASHINGTON	17	121
NEW CHRISTOPHER LYKES	18	127
NEW CK APOLLO	41	10
NEW CLOVER WLB 392	22	
NEW COLUMBUS AMERICA	257	
NEW CONCORDIA STAR	31	73
NEW CORAL ACE	26	
NEW COUNCIL GROVE	1	
NEW CRYSTAL REED	12	
NEW DAFFODIL	36	146
NEW DAUNTLESS CG		113
NEW DAVID STARR JORDAN	52	186
NEW DEL ORO	17	
NEW DEL VIENTO	58	66
NEW DELTA BRASIL	60	108
NEW DIANA	161	101
NEW DOCTOR LYKES	95	307
NEW DONA MAGDALENA		179
NEW DUDME	37	
NEW EAGLE CHARGER	11	24
NEW EASTERN FREEDOM	2	
NEW EASTERN TREASURE	12	
NEW EDWARD RUTLEDGE	40	53
NEW EMPIRE STATE	7	
NEW ESSO MELBOURNE	15	
NEW ESSO TORONTO	1	
NEW EWER VALUE	26	175
NEW EXPORT BUYER	14	117
NEW EXPORT FREEDOM	52	172
NEW EXXON BATON ROUGE	37	132
NEW EXXON GETTYSBURG	33	93
NEW EXXON LEXINGTON	64	160
NEW EXXON PHILADELPHIA	24	120
NEW FEDTRADE	107	47
NEW FORT HOSKINS		11
NEW FREDERICK LYKES	38	
NEW GALLEON AQUAMARINE	32	305
NEW GARDENIA	157	155
NEW GENTSTA	13	12
NEW GLACIER BAY	56	236
NEW GLOMAR PACIFIC	1	
NEW GOLDEN GATE BRIDGE	273	236
NEW GRACE	7	
NEW GREAT REPUBLIC	12	19
NEW GREEN HOPE	65	85
NEW GULF RANGER	27	108
NEW GULF TRADER	63	273
NEW HAGUE AGUS SALIM	9	58
NEW HENJIN INCHEON	12	
NEW HOEGH ELITE	1	
NEW HOEGH MASCOT		15
NEW HOEGH OPAL	16	9
NEW HOEGH PRIDE	6	31
NEW HOTARA MARU	277	109
NEW HUDSON T-AG 194	5	
NEW INTERMARINE VENTURE	1	
NEW ITALICA	43	149
NEW J LOUIS	162	259
NEW JADRAN	20	
NEW JAMES E O'BRIEN	1	113
NEW JAPAN AMBROSE	61	47
NEW JARVIS WMEC 725		93
NEW JOHN M MCCONE		525
NEW JOSEPH LYKES	48	80
NEW KASHU MARU	56	33
NEW KEIYU	33	167
NEW KNORR	108	236
NEW KOREAN JUPITER	29	99
NEW KOREAN PRIDE	194	
NEW LABRADOR CLIPPER	2	
NEW LAKE PALOUNDE	27	259
NEW LASH ITALIA	14	121
NEW LESLIE LYKES	43	192
NEW LILLODET	101	
NEW LONDON CRAFTSMAN	2	
NEW LUIGI GRIMALDI	11	
NEW MALLORY LYKES	118	358
NEW MANISTEE	150	372
NEW MANULEI	123	278
NEW MARCONA EXPORTER	173	541
NEW MARGARET JOHNSON	68	149
NEW MARIA G	67	185
NEW MARITIME HARMONY	26	
NEW MARJORIE LYKES	42	112
NEW MATSONIA	17	36
NEW MAYA	28	64
NEW MAYON	19	12
NEW MELVILLE	64	45
NEW MERCY	37	
NEW MIDAS ONEIN	30	68
NEW MING AUTUMN	1	
NEW MING STAR	22	86
NEW MOBIL COMET	1	
NEW MOBIL VENTURE	1	
NEW MOBILGAS	74	198
NEW NORBAT	90	

SHIP NAME	VIA RADIO	VIA MAIL
NEW NORBELLE LYKES	92	
NEGEAN SUN	1	
NIMPE LYKES	70	140
NILBERT MAERSK	67	30
NILLISON LYKES	34	
NLVA MAERSK	52	164
NMERICAN ACE	157	415
NMERICAN ARCHER	179	203
NMERICAN CHALLENGER	60	66
NMERICAN EXPLORER	32	
NMERICAN LANCER	139	325
NMERICAN LEGEND	99	330
NMERICAN RACER	32	
NMERICANA	78	141
NNCO TEMPLAR	232	
NNTE TOPIC	18	24
NRCO ANCHORAGE	186	264
NRCO PRESTIDE	38	57
NRECIBO	154	206
NRNOLD MAERSK	49	76
NSIA BEAUTY	20	
NSIA HONESTY	16	
NTHEL LEADER	118	73
NTLANTIC RAINBOW	43	192
NUSTRAL ENDURANCE	123	180
NUSTRAL GLEN	1	
NUSTRAL PURITAN	99	58
NXEL MAERSK	95	170
NARNES	2	
NARBER PRIDE	82	86
NARBANCA	286	298
NAY	90	172
NEL HUDSON	1	
NLUE OCEAN	100	298
NORINQUEN	105	246
NRIGHT HOPE	99	
NUNGA CHEMPAKA	1	
NALIFORNIA RAINBOW	135	231
NAPRICORN	90	88
NHANCELLORSVILLE	34	9
NHARLESTON	137	210
NHAUVENET T AGS 29		282
NHERRY VALLEY		125
NHEVRON ARIZONA	69	212
NHEVRON COPENHAGEN	18	238
NHEVRON MISSISSIPPI	101	262
NHEVRON PERMIS	1	90
NHEVRON WASHINGTON	17	121
NHRISTOPHER LYKES	18	127
NK APOLLO	41	10
NLOVER WLB 392	22	
NOLUMBUS AMERICA	257	
NONCORDIA STAR	31	73
NORAL ACE	26	
NOUNCIL GROVE	1	
NRYSTAL REED	12	
NAFFODIL	36	146
NAUNTLESS CG		113
NAVID STARR JORDAN	52	186
NEL ORO	17	
NEL VIENTO	58	66
NELTA BRASIL	60	108
NIANA	161	101
NOCTOR LYKES	95	307
NONA MAGDALENA		179
NUDME	37	
NAGLE CHARGER	11	24
NASTERN FREEDOM	2	
NASTERN TREASURE	12	
NDWARD RUTLEDGE	40	53
NMPIRE STATE	7	
NSSO MELBOURNE	15	
NSSO TORONTO	1	
NWER VALUE	26	175
NXPORT BUYER	14	117
NXPORT FREEDOM	52	172
NXXON BATON ROUGE	37	132
NXXON GETTYSBURG	33	93
NXXON LEXINGTON	64	160
NXXON PHILADELPHIA	24	120
NEDTRADE	107	47
NORT HOSKINS		11
NREDERICK LYKES	38	
NALLEON AQUAMARINE	32	305
NARDENIA	157	155
NENTSTA	13	12
NLACIER BAY	56	236
NLOMAR PACIFIC	1	
NOLDEN GATE BRIDGE	273	236
NRACE	7	
NREAT REPUBLIC	12	19
NREEN HOPE	65	85
NULF RANGER	27	108
NULF TRADER	63	273
NAGUE AGUS SALIM	9	58
NENJIN INCHEON	12	
NARMONY TAGS 32		93
NIET MARU	331	187
NOEGH MASCOT		15
NOEGH OPAL	16	9
NOEGH PRIDE	6	31
NOTARA MARU	277	109
NUDSON T-AG 194	5	
NNTERMARINE VENTURE	1	
NTALICA	43	149
N LOUIS	162	259
NADRAN	20	
NAMES E O'BRIEN	1	113
NAPAN AMBROSE	61	47
NARVIS WMEC 725		93
NOHN M MCCONE		525
NOSEPH LYKES	48	80
NASHU MARU	56	33
NEIYU	33	167
NNORR	108	236
NOREAN JUPITER	29	99
NRROR	194	
NABRADOR CLIPPER	2	
NAKE PALOUNDE	27	259
NASH ITALIA	14	121
NESLIE LYKES	43	192
NILLODET	101	
NONDON CRAFTSMAN	2	
NUIGI GRIMALDI	11	
NALLORY LYKES	118	358
NANISTEE	150	372
NANULEI	123	278
NARCONA EXPORTER	173	541
NARGARET JOHNSON	68	149
NARIA G	67	185
NARITIME HARMONY	26	
NARJORIE LYKES	42	112
NATSONIA	17	36
NAYA	28	64
NAYON	19	12
NELVILLE	64	45
NERCY	37	
NIDAS ONEIN	30	68
NING AUTUMN	1	
NING STAR	22	86
NOBIL COMET	1	
NOBIL VENTURE	1	
NOBILGAS	74	198
NORBAT	90	

MORGENTHAU WMEC 722	74	208
MORMACPARGO	73	214
MORMACSEA	45	140
MORMACVEGA	45	120
MUNRO WMEC 724	735	387
NAVASOTA		140
NEPTUNE DIAMOND	134	262
NEW JERSEY MARU	152	191
NODAWAY	211	231
NORTHWEAL		4
NORSE PILOT	162	39
NORWAY	172	
OCEAN BRAVE	12	15
OCEAN LOG	17	24
OGDEN CONGO	2	
OGDEN THAMES	89	54
OPANCE	129	
ORE MERIDIAN	69	
ORIENTAL COMMANDER	98	232
ORIENTAL JADE	6	
ORIENTAL SOVEREIGN	80	66
ORUNDA	1	
OVERSEAS CHICAGO	54	57
OVERSEAS NEW YORK	37	214
OVERSEAS WASHINGTON	2	
PACTLAKE	45	27
PACIFIC ARROW	259	196
PACLADY	42	27
PACNOBLE	58	56
PAN ANTILLES	1	
PAN PACIFIC	18	
PATHCA	1	
PERMINA SAMUDRA NO.1	1	
PHILLIPS NEW YORK	1	
PIONEER MOON	80	215
POLYNESIA	225	467
PORTUGAL MARU	20	35
PRESIDENT GARCIA	14	67
PRESIDENT JEFFERSON	146	296
PRESIDENT MC KINLEY	127	173
PRESIDENT TAYLOR	65	197
PRESIDENT WILSON	105	268
PROSPERITY QUEEN	18	10
PUERTO RICO	6	
QUIXANA	37	46
RAPHAEL SEMMES	1	
REGINA CELI	1	
RESOLUTE WPC 620	1	
RIO JARUMA	62	
ROSE CITY	1	
RYUJIN	54	264
SAM HOUSTON	1	
SAN JUAN	104	
SANSINENA II	221	449
SANTA CRUZ	40	96
SANTA JUANA	64	164
SANTA MARIANA	27	164
SCANDINAVIAN HIGHWAY	73	289
SEA LAND VOYAGER	54	79
SEALAND CONSUMER	152	357
SEALAND ENDURANCE	72	176
SEALAND GALLANT	141	227
SEALAND MARKET	125	362
SEALAND PRODUCER	56	127
SEALIFT ARABIAN SEA	65	225
SEASPEED ASIA	4	167
SEAWAY	2	
SEVEN OCEAN	1	
SHIRLEY LYKES	44	
SILVERLIGHT	13	
SINCERE NO 5		85
SNOW CRYSTAL	56	6
SOHIO INTREPID	9	142
SOUTHERN CROSS	85	197
SPERO	1	169
STADT BREMEN	25	
STARLAND	27	
STOLT LLANDAFF	67	12
STURDY RUDDER	29	276
SVENDBORG MAERSK	90	27
TACOMA	46	224
TAIJAN PHOENIX	1	
TAMPA	44	101
TERRIER	69	67
TEXACO IOWA	26	90
TEXAS	1	
TFL FREEDOM	26	36
THOMPSON LYKES	37	297
TOKYO RAINBOW	31	
TOSCA	86	87
TOYOTA MARU NO 17	46	117
TRANSCOLUMBIA	97	121
TUSCAN	9	114
UNIQUE FORTUNE	21	
USNS MACGRAW	4	
VAN CHAUCER		127
VELMA LYKES	182	421
VILLANDER	50	140
WASHINGTON TRADER	1	5
WESTWARD VENTURE	113	211
WILMINGTON CITY	216	327
WORLD CANDOUR	129	252
WORLD PRIDE	42	77
YOCONA WMEC 168	20	
YUKON T-AO 152	141	56
ATKH	67	67
AKAA	34	30
ALNH	703	130
BZBS	2	35
BZBT		194
BZMT		52
BZZO		96
DKEL	36	186
DKAV	1	31
DKZP	3	139
DTOS	69	116
DSOV		57
ELAJS	12	27
ELAV	1	112
ELAW3	21	41
ELCP	46	331
ELRJ		1
HBOG	12	15
HFAA	29	159
HGAT	10	29
HHLO	6	24
HSAT	48	760
HSMI	5	111
HSTH	59	106
HSZD		101
JDUS	21	75
JUKT	85	121
JOKW	1	26
KDIK		17
KDWF		45
KLHN	132	356
KROB	2	57
KSEA	10	26
LLNF	38	114
NDEV	19	26
NMRX		121
NVSR		743
OPEN		59
PPWN	46	75
SDPY	50	92
SKSY	16	78
WPOD	80	747
WNCV	46	46
WTOS806		37
ZCAV		8
ZEFI	84	131
ZLFT	67	211
ZMMF		1
ZMZH	20	57
4ZIR	54	183
AACC	4	9
	2	2

MORMACALTAIR	39	250
MORMACLYNX	87	169
MORMACSTAR	103	289
MORMACWAVE	47	106
NAJARA	91	78
NECHES	65	78
NEPTUNE JADE	17	
NEW JERSEY SUN	45	58
NOPAL BRANCO		60
NORDIC LOUISIANA	141	
NORTH STAR III	22	59
NURA DEL MAR	32	38
OCEAN CROWN	1	3
OCEANIC	123	189
OGDEN FRASER	78	228
OGDEN WILLAMETTE	8	63
OMCO MINER	39	90
OPL SATURN	30	
ORIENTAL ESEARCHER	56	57
ORIENTAL LEADER	13	29
ORIENTAL STATESMAN	71	242
OTTO N. MILLER	43	329
OVERSEAS HARRIET	19	62
OVERSEAS OHIO	24	11
PACPARON	42	59
PACEMPEROR	30	
PACIFIC ERA	167	330
PACMAJESTY	39	17
PACPRINCE	53	
PAN ASIA	1	274
PAN WESTERN	55	
PENNMAR	36	
PERRYVILLE	22	
PINK SKY	28	
PIONEER NO 1	29	28
POMPOSA	1	
ROBERT E LEE	25	6
ROYAL VIKING SEA	18	91
SACRAMENTO	42	
SAMOA	11	64
SANPOSTAR	134	240
SANTA ADELA	24	
SANTA ELENA	15	162
SANTA LUCIA	45	167
SANTA MERCEDES	7	4
SCANSPHALE	126	310
SEA TRANSPORT	1	
SEALAND CHALLENGER	8	
SEALAND EXPRESS	167	353
SEALAND INDEPENDENCE	65	233
SEALAND MCLEAN	38	165
SEALAND RESOURCE	90	54
SEALIFT CARIBBEAN	22	104
SEALIFT PACIFIC	3	11
SEATRAIN OPERATION	73	
SEDGE WLB 402	24	
SHELDON LYKES	10	
SHUNYO	124	197
SIMBA	126	167
SNAUGRAM	173	222
SNOW WHITE	1	
SOLON TUMAN	43	10
SOUTHARC	76	76
SPURY CHURCH	32	
STAR SIRPPE	121	
STARGRAFT WMEC 623		92
STONEWALL JACKSON	22	40
SUCCESSFUL VENTURE	2	
SWEETBRIER WLB 405	28	
TAURITAN	1	
TALISMAN	17	16
TANEY WHEC 37	34	
TEXACO FLORIDA	12	60
TEXACO MASSACHUSETTS	4	
TEXAS CLIPPER	10	
THOMAS F THOMPSON	160	228
THUMPSON PASS	35	67
TOLUCA	15	56
TOWASEND CROMWELL	119	140
TOYOTA MARU NO 24	142	51
TRINITY	14	23
TYSON LYKES	134	268
UNITED SPIRIT	43	440
VALIANT		72
VAN FORT	39	57
VERRAZANO BRIDGE	187	122
VIOLET	94	
WASHINGTON WOOD	10	240
WESTWIND WASH 281	57	63
WINTER MOON	4	70
WORLD CREST	1	
WORTH	32	
YOUNG AMERICA	48	120
ZIM MONTREAL	26	
ATUJ	47	15
ARYD	35	61
BMOF	66	167
CBCQ	15	44
CFJT	1	19
CFSO	14	244
CFUM	40	174
CFZC	144	320
CKAD		58
CTAH	48	23
LBPU	47	49
LSFE	21	47
ELAR	7	6
ELAW4	6	42
ELAY5	16	45
ELFY		54
ELWC		4
HBKW	43	246
HFAW	28	16
HGJE	52	66
HHEC	21	34
HSCH	29	126
HSND	14	72
HSWM	43	225
JDLK		36
JFJS	27	63
JFAM	44	76
JFND	59	71
KCXP		120
KHLC		5
KNEX	15	67
KSCR		11
KSDM		24
LPUR	12	21
NDLW		5
NNUN		1364
NOCF		1
OPPS	54	163
PPAD		140
SCGF	148	212
WDJB	42	271
WNAW	73	268
WTX3261		36
JEBB		59
JEJE	20	24
JFJA	10	286
SMDJ	13	8
WJUB	43	77
YJUB	56	95
BMAF	244	204
	241	141

MORMACARGO	39	114
MORMACBIDEL	59	177
MORMACSUN	132	229
MORNING GLORY	18	
NANCY LYKES	13	
NEPTUNE AMBER	126	347
NEPTUNE RUBY	6	
NEW YORK MARU	63	28
NOPAL LANE	20	
NORDIC PRINCE	6	
NORTHERN LIGHT	67	122
NYHORN	1	
OCEAN DUKE	1	
OCEANOGRAPHER	285	356
OGDEN JORDAN	109	256
OLEANDER	298	705
OMCO TRADER	76	184
OREGON	2	
ORIENTAL EXECUTIVE	48	53
ORIENTAL MERCHANT	9	32
ORIENTAL TATO		452
OVERSEAS ALEUTIAN	37	39
OVERSEAS JUNEAU	87	87
OVERSEAS ULLA	18	
PACBARONESS	29	10
PACGLORY	74	
PACIFIC SAGA	84	107
PACMERCHANT	30	12
PACPRINCESS	30	
PAN DYNASTY	27	
PARALLA	67	67
PEREIRA OTECA	1	
PHILADELPHIA	197	703
PIONEER COMMANDER	1	
POLAR SEA	60	
PONCE	1	44
PRESIDENT CLEVELAND	114	274
PRESIDENT HOOVER	200	279
PRESIDENT KENNEDY	7	
PRESIDENT POLK	143	182
PRESIDENT TYLER	148	330
PRINCE WILLIAM SOUND	6	158
PROVINCIA DE EL ORO	4	32
QUETICO WAY RELIEF	298	724
RAINIER	28	
RED JACKET	57	141
RESEARCHER	340	463
RHINE ORE	7	
RODRIGUES CABRILHO	46	156
ROYAL VIKING SKY	30	24
SALVADOR	60	165
SAMUEL S	19	
SANKOSTELL	19	98
SANTA BARBARA	33	28
SANTA FE	167	191
SANTA MAGDALENA	10	
SARDOONA	117	244
SCILLA	52	
SEALAND ADVENTURER	106	258
SEALAND DEVELOPER	174	334
SEALAND FINANCE	92	127
SEALAND INNOVATOR	140	306
SEALAND PATRIOT	146	269
SEALAND VENTURE	72	235
SEALIFT PACIFIC	10	
SEATRAIN YORKTOWN	1	
SEAT ROMANO	13	25
SHERMAN WMEC 720	87	247
STENA	124	150
SUNALCA	136	330
SKOGHOLD	114	304
SNOWFLOWER	23	46
SONS OF NORWAY	11	
SOUTHWEST CAPE	106	
SPRAY STAR	46	
STAR DOVER	95	304
STELLA LYKES	62	169
STOPIS WASH 34	2	
SUGAR ISLANDER	141	164
T F L INDEPENDENCE	15	
TAI JOHN	13	10
TALUGA T-AO-62	47	
TALPUS	27	112
TEXACO GEORGIA	24	41
TEXACO NEW YORK		6
TEXAS TRADER	106	346
THOMAS NELSON	7	24
TILLIE LYKES	99	269
TONCI TOMIC	90	347
TOYOTA MARU 10	116	172
TRANSCHAMPLAIN	2	
TRIUMPH	77	
ULTRASEA	12	16
UNION PROGRESS	20	
VALLEY FORGE	91	106
VAN HENK	37	79
VICENTE GUERRERO	2	
WALCHAND	9	
WESPA EXPRESS	341	466
WHITING	25	56
WINTER WATER	65	129
WORLD HERCULES	2	53
WYOMING	26	64
ZIM MONTREAL	47	95
ZIM MONTREAL	115	143
ZIM ISRAEL		25
ARPW	34	203
CFMO	10	24
CFWC	84	112
DZSY	70	300
DZTP	7	43
DSVK	143	268
DSXP	47	58
DTOR	27	55
DZAP		88
EMDK	4	23
ELAP3	1	91
ELAV5	167	412
FLCJ	6	772
FLTJ	50	136
FLXT	4	4
HJEN	89	76
HKAV	14	25
HMGO		19
HRAF	11	87
HSKD	30	65
HSLL	15	11
HSLT	11	42
JMJD	70	110
JPDM		4
JPMJ		33
JPRD	4	16
KFGT	211	94
KSLB		16
KWJH	143	344
KSQF		14
KSLD	32	40
NMSZ	52	254
NEFK		65
NOSI		34
OWPH		4
OYEF	62	106
SWDF	4	23
SWCH		15
VPFF	88	145
WFCS	147	265
WSDP		36
WTX5902	32	127
ZEED		31
3FJA	26	220
5LUB	2	8
5PUF	123	507
6ZRT	16	259
7KQS	19	94
9VKD	19	23
	19	20

MORMACDAWN		1
MORMACSAGA	24	55
MORMACTIDE	52	196
MT MITCHELL	83	180
NATIONA		1
NEPTUNE CRYSTAL	30	
NEW GOLDEN PHOENIX	126	203
NEWARK	143	288
NOPAL SEL	119	153
NORDIC REGENT	1	
NORTHWIND WAGB 282	252	397
OAKLAND	15	57
OCEAN GOLF	10	
OCTA	29	85
OGDEN SENEGAL	114	304
OLGA TOPIC	20	77
ORE JUPITER	77	
ORIENTAL CHAMPION	6	
ORIENTAL EXPORTER	5	
ORIENTAL QUEEN	13	
ORIENTAL TRADER	1	
OVERSEAS ARCTIC	59	130
OVERSEAS MARILYN	87	207
OVERSEAS VALDEZ	80	91
PACDUCHESS	31	20
PACIFIC ACE	49	100
PACIFIC VENTURE	228	623
PACMONARCH	47	6
PACSTAR	60	7
PAN KOREA	40	142
PASSUMPSIC AO-107		157
PERENNIAL ACE	286	961
PHILIPPINE CORREGIDOR	14	148
PIONEER CONTENDER	12	135
POLAR STAR WAGB-10	149	47
PORTLAND	205	268
PRESIDENT FILLMORE	130	386
PRESIDENT JACKSON	45	32
PRESIDENT MADISON	103	158
PRESIDENT TAFT	193	323
PRESIDENT VAN BUREN	150	345
PROSPERITY	29	
PUEBLA	10	
QUINTINA	104	62
RALPH B JOHNSON		22
REGENT CEDAR	110	150
RESOLUTE	79	125
RICHARD	123	190
ROSE	3	312
RUTH LYKES	51	219
SALVIA WLB 400	3	
SAN BRUNO		68
SANKOSUN	28	10
SANTA CLARA	166	420
SANTA ISABEL		14
ANTA MARIA	32	76
ITSUMA	73	234
A PAN	23	
SEALAND COMMERCE	81	114
SEALAND ECONOMY	119	299
SEALAND FREEDOM	147	340
SEALAND LEADER	54	268
SEALAND PIONEER	62	178
SEALIFT ANTARTIC	41	103
SEASPEED ARABIA	1	
SEATTLE	51	54
SEPTA	19	112
SHING SN	26	121
SILVER PHOENIX	69	62
SINCERE NO 3	33	
SKYWARD	35	22
SOCONY VACUUM	25	135
SOUTH LIGHT	65	17
SPAIN MARU	90	87
SPRUCE	40	
STAR HONGKONG	102	35
STOLT DRAGON	2	
STRAIT HAWSER	49	55
SUSQUEHANNA	30	108
T F L LIBERTY	17	37
TAIKO VENTURE	71	
TAMARDA WMEC-146		26
TENNESSEE	54	108
TEXACO GHENT	104	
TEXACO RHODE ISLAND	4	
TFL DEMOCRACY	19	168
THOMAS WASHINGTON	1	2
TOMPES MARU	39	22
TONSINA	86	441
TOYOTA MARU 12	302	484
TRANSCOLORADO	52	44
TROPICANA	2	
UNION PROGRESS	3	18
USNS BARRLETT	10	11
VALOR	34	151
VANGUARD	6	168
VIENNA WOODS	83	95
WALTER RICE	140	352
WESTERN SUN	7	99
WILLIAM E MUSSMAN	13	148
WOODRUSH WLB407	5	
WORLD MEDAL	30	36
YAMASHIN MARU	272	286
YOUNG SEAGULL	33	
ZELLA LYKES	86	193
ARTH	4	4
BMEC	7	55
CSDM	3	2
DZCL		2
DZJQ	7	60
DZMO	2	4
DSEN	56	250
DSWE	12	42
DTRV		2
DROK	5	8
ELAS4		129
ELASN	18	124
ELAW		44
ELCK	25	7
ELCN	13	17
ELYM	25	56
HMSM	93	403
HJSY		10
HRJO		262
HSWU	81	225
HRJU	20	40
HRJW	4	6
HYQM	5	52
JCUF	3	5
JFMT	63	54
JMJM	92	86
JREG	19	36
KDEB	14	69
KISP		40
KPEL	8	44
KSFJ	4	10
LICY	44	357
NCDS	8	11
NMMA	36	69
NQSJ		5
OXBF		139
PPIJ		32
SGLN	15	16
SOED	59	149
WDQF		8
WGUF	103	87
WTX9902	162	373
WZL8190		38
3EEJ		66
3FYC	47	58
4XAN	42	64
5MYK		18
6ZSY	71	138
7LVB	5	13
9VUS	23	32
	17	176

SUMMARY: GRAND TOTAL VIA RADIO 65851 GRAND TOTAL VIA MAIL 30398

U.S. Ocean Buoy Climatological Data

October, November and December 1981

OCTOBER 1981			TOTAL FREQUENCY OF WIND SPEEDS (%)							TOTAL FREQUENCY OF WIND DIRECTIONS (%)							
BUOY	LAT	LONG	CALM	<4KT	4-10KT	11-21KT	22-33KT	34-47KT	>47KT	N	NE	E	SE	S	SW	W	NW
41002	32.3N	075.3W	1.0	8.1	27.9	47.1	17.0			18.3	26.6	10.6	11.1	12.3	9.5	1.9	7.7
41003	30.3N	080.4W	0.1	8.6	31.6	52.2	7.5			22.1	22.0	20.2	11.4	7.5	6.6	4.0	6.2
41004	32.6N	078.7W		1.0	32.3	57.3	9.4			11.6	38.0	7.4	1.5	11.5	16.7	10.7	2.6
41005	31.7N	079.7W	0.4	7.1	37.2	45.6	10.0			16.0	33.6	8.5	6.5	12.4	8.7	7.5	4.9
42001	25.9N	089.7W	0.1	5.2	43.1	48.7	3.0			4.7	21.2	50.4	14.3	5.9	0.8	0.7	2.1
42002	26.0N	093.5W		2.8	42.6	52.2	2.4			7.2	14.1	32.0	34.7	6.1	3.2	0.6	2.0
42003	26.0N	086.0W	0.7	4.6	47.7	46.1	1.7			16.0	47.6	22.8	3.0	5.1	1.4	0.4	3.6
42007	30.1N	088.9W	1.1	6.4	38.6	48.2	6.8			8.7	21.8	26.6	19.8	6.0	5.5	5.0	6.6
42008	28.7N	095.3W		0.6	20.6	70.2	8.7			11.7	10.8	15.3	40.8	12.1	3.3	0.4	5.7
42010	29.7N	093.4W	0.4	4.1	40.2	50.5	5.1			16.2	20.4	27.4	19.7	10.9	1.5	0.3	3.7
42011	29.6N	093.5W		1.3	34.2	58.6	5.9			5.3	13.2	15.6	46.3	14.7	4.4	0.7	0.3
44003	40.8N	068.5W	0.8	1.4	17.3	76.3	5.0			13.1	14.8	15.5	2.8	15.8	9.1	12.6	16.3
44005	42.7N	068.3W	0.1	1.9	23.3	54.8	20.0			17.8	9.4	9.9	6.0	14.1	11.5	16.6	14.6
44006	36.3N	075.4W	1.0	2.8	22.6	52.2	22.4			32.4	7.7	4.4	9.3	11.5	10.9	6.6	17.3
45001	48.0N	087.6W	1.0	8.6	38.0	51.4	2.0			6.8	8.1	28.5	15.4	8.5	9.5	11.6	11.7
45002	45.3N	086.3W	1.4	8.9	42.0	43.6	5.4			12.6	7.5	8.2	12.5	16.6	19.0	5.9	17.7
45003	45.3N	082.8W	0.3	5.6	48.1	40.9	5.4			6.9	9.4	11.0	12.6	17.7	10.4	12.7	19.3
45004	47.2N	086.5W	3.1	10.0	33.2	45.9	10.8			12.0	5.6	7.6	17.7	20.7	9.1	8.4	18.9
45005	41.7N	082.5W	0.8	2.8	31.1	53.4	12.5	0.2		1.2	10.6	25.4	19.9	19.7	13.7	6.1	3.3
45006	47.3N	090.0W	1.8	12.5	61.7	25.8				6.4	5.2	11.3	17.0	10.6	19.0	16.1	14.5
45007	42.7N	087.1W	2.2	6.7	43.4	45.5				10.1	11.3	11.7	17.1	16.3	10.1	8.3	15.1
45008	44.3N	082.4W	0.7	4.7	36.1	45.5	4.5			19.6	10.9	11.7	12.6	15.4	9.6	6.9	13.5
46001	56.0N	148.0W		2.8	16.1	61.2	17.9			2.1	1.1	0.5	9.2	12.6	17.1	28.8	28.5
46002	42.5N	130.0W		1.4	18.1	75.1	5.4			28.2	23.7	0.3	<.05	4.7	11.4	19.6	15.1
46003	52.0N	156.0W		2.1	16.4	44.7	33.1	3.6		4.4	2.2	5.4	14.7	13.4	9.4	20.8	29.7
46004	51.0N	136.0W	0.1	3.6	22.0	56.4	17.8	0.1		3.7	2.5	3.7	9.7	9.6	15.0	29.2	26.6
46005	46.0N	131.0W	2.6	8.9	20.1	66.3	4.7			24.3	12.6	1.3	2.1	4.3	11.2	16.8	27.4
46006	40.7N	137.7W		1.5	19.6	56.3	22.5	0.1		8.2	16.0	14.8	14.4	2.4	10.2	12.5	21.5
46010	46.2N	124.2W	0.1	9.4	39.7	41.2	9.7			21.3	11.3	11.3	6.1	23.0	16.0	6.0	5.0
46011	34.9N	120.9W	0.7	6.5	45.9	46.6	1.0			22.1	4.7	3.1	4.9	2.9	2.3	4.3	55.7
46012	37.4N	122.7W	2.9	15.8	58.1	25.1	1.0			15.5	2.1	1.6	11.4	11.5	2.8	8.8	46.2
46013	38.2N	123.3W	2.8	15.7	46.5	35.3	2.5			3.2	4.1	4.9	10.0	5.6	4.8	16.6	50.9
46014	39.2N	124.0W	4.0	19.0	46.6	27.5	6.8	0.1		28.4	6.5	9.9	10.9	13.4	3.6	2.2	25.1
51001	23.4N	162.3W	1.0	2.1	21.2	74.3	2.4			3.5	53.6	36.9	5.4	0.7			

OCTOBER 1981			% FREQUENCY OF WIND SPEEDS (<4 KTS)								% FREQUENCY OF WIND SPEEDS (4-10 KTS)								% FREQUENCY OF WIND SPEEDS (11-21 KTS)							
BUOY	LAT	LONG	N	NE	E	SE	S	SW	W	NW	N	NE	E	SE	S	SW	W	NW	N	NE	E	SE	S	SW	W	NW
41002	32.3N	075.3W	0.6	0.6	0.8	1.9	1.9	1.5	0.6	0.2	4.7	6.3	3.3	4.9	4.6	1.9	0.5	1.6	8.1	12.7	6.4	4.2	5.3	5.3	0.2	4.8
41003	30.3N	080.4W	0.8	1.4	2.4	1.0	0.7	0.6	0.8	1.1	1.8	7.0	9.8	5.9	1.8	2.3	0.5	2.5	15.4	10.6	8.0	4.4	5.0	3.7	2.6	2.3
41004	32.6N	078.7W		0.2	0.2	0.2			0.2		4.5	9.4	5.4	1.2	2.0	4.5	4.0	1.3	5.8	20.7	1.6		9.5	12.0	6.1	1.3
41005	31.7N	079.7W	0.5	0.9	0.7	1.7	1.8	0.5	1.2	0.3	6.3	8.4	5.5	3.0	4.9	3.3	3.2	2.5	9.6	16.2	2.3	2.2	5.7	4.9	3.1	1.8
42001	25.9N	089.7W	0.1	0.8	1.9	1.5	0.3	0.2	0.3		1.9	7.0	19.8	9.7	2.7	0.3	0.3	1.5	2.1	10.9	26.7	3.0	2.9	0.3	0.2	0.6
42002	26.0N	093.5W	0.1	0.8	0.8	0.6	0.5	<.05			2.4	4.7	14.4	17.4	2.3	1.0	0.2	0.2	3.3	7.6	16.8	16.7	3.4	2.1	0.4	1.9
42003	26.0N	086.0W	0.4	1.2	0.6	0.2	0.6	0.7	0.2	0.2	7.7	22.7	11.4	1.8	0.7	0.6	0.2	2.6	6.9	23.5	13.2	1.0	3.6	0.1		0.6
42007	30.1N	088.9W	0.2	0.7	1.4	2.2	0.8	0.3	0.6	0.2	3.0	4.5	8.1	10.9	4.2	4.2	1.4	2.4	2.9	13.8	16.4	6.5	0.9	1.0	2.7	4.1
42008	28.7N	095.3W		<.05	0.1	0.3		0.1			1.3	4.5	5.8	6.9	1.3	0.4	0.1	0.4	5.4	5.5	9.4	33.0	10.8	2.7	0.2	3.2
42010	29.7N	093.4W	0.4	0.8	1.2	0.4	1.1	0.2	0.1		4.6	9.9	12.1	8.2	4.1	<.05	0.2	1.1	7.7	8.7	14.1	11.1	5.6	1.2		2.4
42011	29.6N	093.5W	0.5	0.1		0.1	0.2	0.3		0.3	1.9	3.7	4.9	14.6	6.0	2.3	0.7	0.1	1.2	5.3	10.2	31.6	6.5	1.8		
44003	40.8N	068.5W		0.1	0.5	<.05	0.3	0.3	0.1		1.2	1.5	1.6	0.6	7.0	2.0	1.9	1.6	11.5	13.1	13.5	2.3	8.4	6.8	8.9	11.9
44005	42.7N	068.3W	0.3	0.5	0.2	0.3	0.1	0.1	0.1	0.2	5.5	2.4	2.5	3.3	3.3	1.6	2.6	2.7	7.2	6.3	7.2	2.0	8.4	7.9	8.7	7.1
44006	36.3N	075.4W	0.1	0.2	0.5	0.9	0.1	0.6	0.4		3.4	1.1	3.2	5.0	3.2	1.5	2.5	2.6	14.3	4.6	0.7	3.4	6.2	8.7	3.0	11.4
45001	48.0N	087.6W	1.1	0.5	0.5	1.6	2.8	0.7	0.5	0.9	1.7	2.4	9.8	4.1	4.3	6.8	4.4	4.5	3.7	4.7	17.7	9.5	1.4	2.0	6.1	6.1
45002	45.3N	086.3W	1.2	1.5	1.5	0.6	1.2	1.5	0.6	0.9	5.2	5.9	5.8	8.9	4.7	4.6	3.0	3.9	6.1	0.1	1.0	3.0	10.4	10.6	2.3	10.0
45003	45.3N	082.8W	0.8	1.1	0.5	0.7	0.9	0.4	0.6	0.6	3.6	7.1	8.2	10.1	7.0	3.3	4.4	4.5	2.5	1.2	2.3	1.8	9.6	6.3	5.0	12.2
45004	47.2N	086.5W	0.3	2.0	1.1	0.6	2.2	0.5	2.3	1.0	4.1	1.1	3.2	8.2	5.3	2.0	3.6	5.7	6.2	1.4	2.7	8.9	12.1	4.5	2.3	7.9
45005	41.7N	082.5W	0.2	0.3	0.3	0.5	0.2	0.4	0.9	<.05	0.2	3.9	7.4	6.6	6.6	3.4	0.2	0.9	0.8	6.5	17.4	10.1	9.1	5.1	2.9	1.6
45006	47.3N	090.0W	1.2	1.0	0.7	1.6	1.9	2.5	1.7	1.9	3.4	2.9	8.4	14.3	7.1	8.4	10.7	6.4	1.7	1.3	2.2	1.0	1.6	8.0	3.7	6.2
45007	42.7N	087.1W	0.6	1.9	1.1	0.2	1.3	0.3	0.1	1.1	5.8	7.2	7.8	7.1	5.9	3.4	2.1	4.1	3.3	2.2	2.8	9.8	9.1	6.1	4.2	8.0
45008	44.3N	082.4W	1.4	0.5	1.0	1.1	0.4	0.3		<.05	5.8	8.0	7.4	6.8	2.4	2.0	1.1	2.5	9.9	2.3	3.1	4.7	11.2	6.0	3.5	5.1
46001	56.0N	148.0W	0.1	0.3	0.3	0.1	0.2	0.5	0.7	0.5	0.3	0.8		0.9	1.6	4.9	6.0	3.7	1.8		0.2	6.4	8.6	11.5	13.3	19.3
46002	42.5N	130.0W	0.3					0.3	0.6	0.3	9.4	4.2	0.2		0.4	0.9	1.3	1.6	18.5	16.5	0.1	<.05	3.5	8.1	15.6	12.7
46003	52.0N	156.0W		0.2	0.2	0.3	0.2	0.1	0.5	0.6	1.8	0.7	1.8	3.3	2.1	2.1	2.2	2.5	1.6	1.4	3.4	5.3	7.0	6.2	7.9	11.9
46004	51.0N	136.0W		0.1		0.3	0.2	0.8	1.9	0.2	1.1	0.6	1.9	1.1	1.2	4.2	5.8	6.0	2.0	0.6	0.1	6.8	4.9	8.4	16.1	17.4
46005	46.0N	131.0W	2.5	0.6	0.8	0.1		0.4	1.2	3.2	5.8	0.7	0.5	1.1	1.7	1.6	3.1	5.7	16.0	11.2		0.5	2.1	7.5	10.7	18.4
46006	40.7N	137.7W			0.4	0.6		<.05	0.2	0.3	2.4	3.4	7.6	3.1		0.5	0.6	1.9	5.9	12.3	6.6	10.8	2.3	3.7	6.1	8.5
46010	46.2N	124.2W	0.6	0.7	0.6	1.6	1.4	1.7	2.0	0.8	7.4	7.9	6.2	3.2	4.4	4.5	3.2	2.8	13.2	2.7	4.3	1.2	10.3	7.2	0.8	1.4
46011	34.9N	120.9W	0.9	0.6	1.0	1.5	0.9	0.5	0.7	0.5	11.6	3.7	2.1	3.3	1.6	1.7	2.6	19.2	9.6	0.4		<.05	0.4	0.2	0.9	35.0
46012	37.4N	122.7W	3.1	0.9	1.4	2.0	1.8	1.1	1.9	3.7	10.8	0.9	0.4	4.8	6.6	1.2	5.9	27.6	1.5	0.4		4.2	2.5	0.5	1.0	14.9
46013	38.2N	123.3W	2.1	3.2	1.4	1.6	1.5	0.6	2.2	3.3	1.1	0.7	3.5	3.9	1.9	3.9	9.5	21.9		0.1		3.7	1.9	0.3	4.6	24.8
46014	39.2N	124.0W	3.4	3.7	2.6	2.4	2.5	1.1	1.1	2.2	16.6	2.6	7.4	4.1	3.4	1.0	0.6	10.8	6.3	0.1		2.3	5.3	1.5	0.5	9.5
51001	23.4N	162.3W	0.3	0.6	0.3	0.9					1.3	10.4	6.4	2.4	0.7				1.8	40.4	30.0	2.1				

OCTOBER 1981			% FREQUENCY OF WIND SPEEDS (22- 33 KTS)								% FREQUENCY OF WIND SPEEDS (34-47 KTS)								% FREQUENCY OF WIND SPEEDS (>47 KTS)							
BUOY	LAT	LONG	N	NE	E	SE	S	SW	W	NW	N	NE	E	SE	S	SW	W	NW	N	NE	E	SE	S	SW	W	NW
41002	32.3N	075.3W	5.0	9.0			0.5	0.7	0.6	1.2																
41003	30.3N	080.4W	4.1	7.1						0.3																
41004	32.6N	078.7W	1.3	7.6				0.1	0.4																	
41005	31.7N	079.7W	1.6	8.1						0.3																
42001	25.9N	089.7W	0.5	2.5																						
42002	26.0N	093.5W	1.3	1.0																						
42003	26.0N	086.0W	1.0	0.2	0.4					0.1																
42007	30.1N	088.9W	2.7	2.9	0.7	0.3			0.2																	
42008	28.7N	095.3W	5.0	0.9		0.6		0.1		2.1																
42010	29.7N	093.4W	3.5	1.4						0.2																
42011	29.6N	093.5W	1.6	4.1																						
44003	40.8N	068.5W	0.4				0.1		1.6	2.8																
44005	42.7N	068.3W	4.6	0.3		0.4	2.3	1.9	5.2	5.1																
44006	36.3N	075.4W	14.5	1.8		<.05	2.0	<.05	0.7	3.3																
45001	48.0N	087.6W	0.3	0.5	0.4	0.3			0.5	<.05																
45002	45.3N	086.3W	0.1				0.2	2.2		2.9																
45003	45.3N	082.8W					0.2	0.5	2.7	2.0																
45004	47.2N	086.5W	1.4	1.0	0.6	<.05	1.1	2.3	0.1	4.3																
45005	41.7N	082.5W		<.05	0.4	0.7	3.6	4.8	2.1	0.8					0.2											
45006	47.3N	090.0W																								
45007	42.7N	087.1W	0.3					0.3	1.9	1.9																
45008	44.3N	082.4W	2.5		0.1	0.4	1.5	1.3	2.2	5.9																
46001	56.0N	148.0W				1.8	2.1	0.2	8.8	5.0																
46002	42.5N	130.0W					0.7	2.0	2.2	0.6																
46003	52.0N	156.0W	1.0			4.7	3.5	0.9	9.9	13.1				1.1	0.6		0.3	1.6								
46004	51.0N	136.0W	0.6	1.1	1.5	1.6	3.3	1.5	5.3	3.0			0.1													
46005	46.0N	131.0W	0.1			0.5	0.5	1.7	1.8	0.2																
46006	40.7N	137.7W		0.3			0.1	6.0	5.6	10.6								0.1								
46010	46.2N	124.2W				0.2	7.0	2.6																		
46011	34.9N	120.9W								1.0																
46012	37.4N	122.7W				0.3	0.6																			
46013	38.2N	123.3W				0.9	0.2		0.1	1.3																
46014	39.2N	124.0W	0.1			2.0	2.2			2.5				0.1												
51001	23.4N	162.3W		2.2	0.2																					

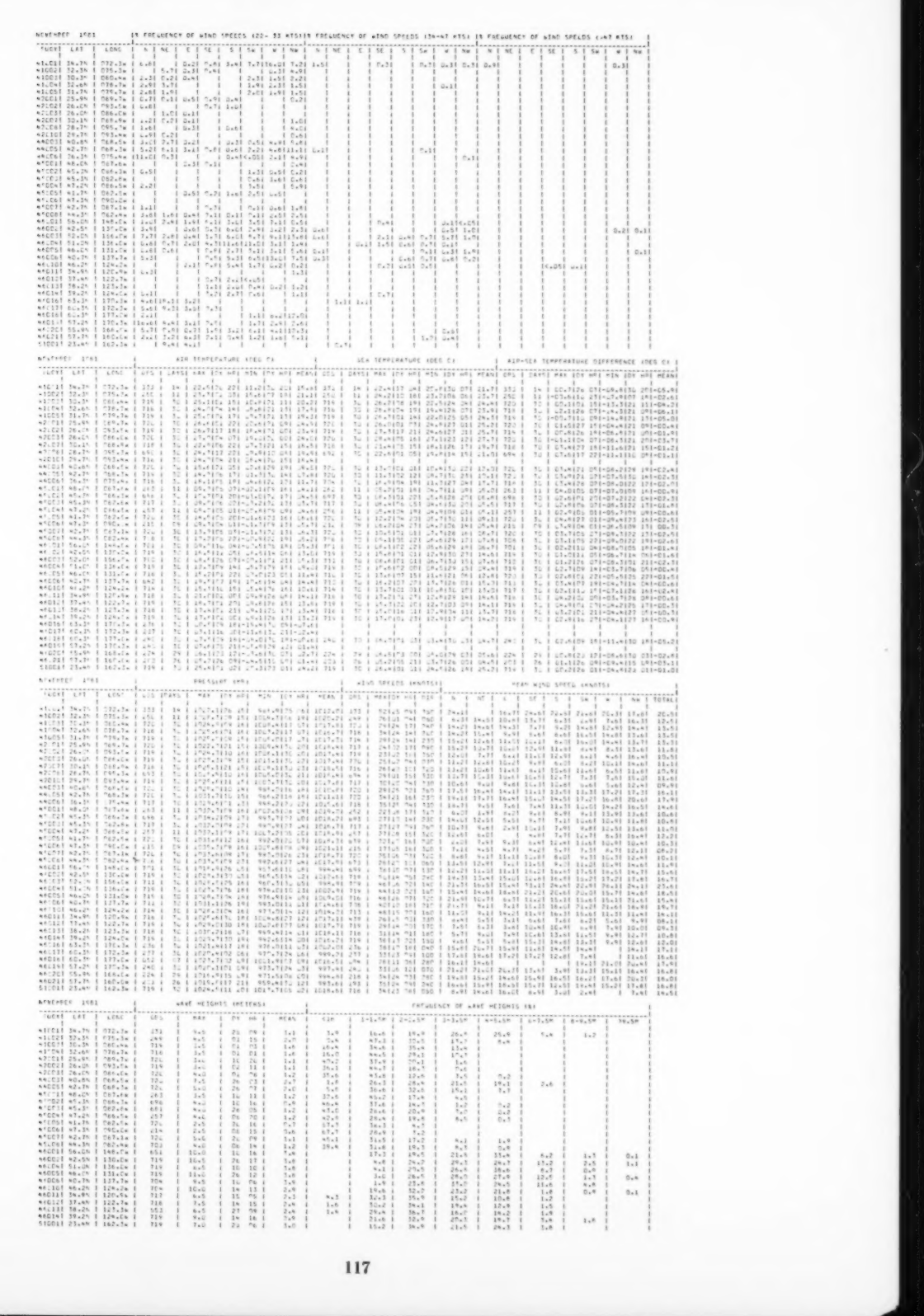
OCTOBER 1981			WAVE HEIGHTS (METERS)					FREQUENCY OF WAVE HEIGHTS (%)							
BUOY	LAT	LONG	OBS	MAX	DY	HR	MEAN	<1M	1-1.5M	2-2.5M	3-3.5M	4-5.5M	6-7.5M	8-9.5M	>9.5M
41002	32.3N	075.3W	720	4.5	14	06	1.7	5.8	56.2	20.6	17.9	4.1			
41003	30.3N	080.4W	606	4.0	13	06	1.7	10.7	50.3	19.3	17.1	2.4			
41004	32.6N	078.7W	720	3.5	13	22	1.5	13.3	46.3	28.3	10.0				
42001	25.9N	089.7W	692	3.5	19	13	0.9	40.1	53.0	5.0	1.7				
42002	26.0N	093.5W	720	3.5	24	04	1.0	32.6	57.0	7.0	3.1				
42003	26.0N	086.0W	722	3.5	19	17	1.0	35.5	52.4	9.6	2.2				
44003	40.8N	068.5W	587	4.5	20	01	2.0	0.8	40.2	39.6	16.1	3.0			
44005	42.7N	068.3W	720	3.5	19	07	1.5	11.2	58.0	24.5	6.1				
45001	48.0N	087.6W	716	4.5	18	16	1.2	29.0	48.6	16.7	4.1	1.3			
45002	45.3N	086.3W	719	4.0	25	02	1.0	41.7	37.4	15.9	4.5	0.2			
45003	45.3N	082.8W	451	4.0	07	05	1.2	33.4	38.1	21.5	6.6	0.2			
45004	47.2N	086.5W	720	7.0	16	18	1.2	35.8	41.2	15.1	5.5	1.1	1.1		
45005	41.7N	082.5W	716	2.5	18	18	0.9	38.2	58.2	3.4					
45006	47.3N	090.0W	719	5.0	01	17	0.9	42.9	46.3	5.4	4.0	1.2			
45007	42.7N	087.1W	719	4.5	02	07	1.2	36.4	39.4	16.5	6.1	1.3			
45008	44.3N	082.4W	720	4.5	19	04	1.3	33.4	40.6	14.8	8.8	2.0			
46001	56.0N	148.0W	673	5.5	18	15	2.9		16.4	26.4	33.4	23.6			
46002	42.5N	130.0W	726	7.0	07	16	2.4	1.1	21.8	49.3	9.5	16.9	1.2		
46004	51.0N	136.0W	723	7.5	05	23	2.6	1.9	27.2	27.2	23.9	18.9	0.6		
46005	46.0N	131.0W	720	8.5	07	10	2.5	6.3	24.5	35.1	15.1	15.9	2.3	0.4	
46006	40.7N	137.7W	719	6.5	07	02	2.5	0.1	32.5	35.8	11.9	17.5	1.9		
46010	46.2N	124.2W	709	6.0	08	01	2.0	6.3	42.7	23.8	15.2	11.7	0.1		
46011	34.9N	120.9W	719	3.5	08	15	1.5	7.5	62.7	22.3	7.3				
46012	37.4N	122.7W	722	4.0	29	13	1.5	12.3	49.4	30.3	7.0	0.8			
46013	38.2N	123.3W	703	4.0	29	17	1.5	17.9	45.8	28.0	7.6	0.5			
46014	39.2N	124.0W	717	6.5	08	06	1.9	8.9	41.8	29.8	12.5	6.5	0.2		
51001	23.4N	162.3W	712	4.0	27	17	2.1		25.2	63.0	10.9	0.7			

OCTOBER 1981			AIR TEMPERATURE (DEG C)							SEA TEMPERATURE (DEG C)							AIR-SEA TEMPERATURE DIFFERENCE (DEG C)						
BUOY	LAT	LONG	OBS	DAYS	MAX	DY HR	MIN	DY HR	MEAN	OBS	DAYS	MAX	DY HR	MIN	DY HR	MEAN	OBS	DAYS	MAX	DY HR	MIN	DY HR	MEAN
41002	32.3N	075.3W	720	31	27.4	02 20	18.3	20 00	22.7	720	31	27.8	01 18	23.7	23 11	25.3	720	31	00.8	27 14	-07.9	03 13	-02.6
41003	30.3N	080.4W	719	31	27.8	03 02	18.0	19 17	24.1	719	31	27.9	01 21	24.9	22 01	26.2	719	31	00.9	03 02	-08.4	19 17	-02.1
41004	32.6N	078.7W	405	18	27.4	02 22	15.4	03 10	22.0	726	31	26.8	01 02	23.4	27 19	24.8	720	31	01.5	02 22	-09.7	03 10	-03.2
41005	31.7N	079.7W	722	31	27.8	02 23	17.3	19 15	22.9	722	31	28.4	01 13	23.5	16 10	26.2	722	31	01.8	26 20	-09.6	03 13	-03.2
42001	25.9N	089.7W	699	31	30.5	08 15	23.1	26 13	27.4	698	31	28.8	03 19	25.4	30 11	27.0	701	31	03.0	08 15	-03.4	26 13	00.4
42002	26.0N	093.5W	720	31	29.0	07 20	20.6	28 02	26.3	726	31	30.3	02 21	26.5	28 07	28.2	720	31	00.2	25 14	-06.1	28 02	-01.9
42003	26.0N	086.0W	723	31	28.1	11 14	22.1	20 07	26.3	723	31	30.1	18 20	27.8	02 06	28.5	723	31	-00.3	11 14	-06.3	20 07	-02.2
42007	30.1N	088.9W	456	20	27.9	02 23	11.4	24 12	21.3	456	20	27.8	01 19	20.3	29 12	23.9	456	20	03.0	22 21	-11.1	24 12	-02.7
42008	28.7N	095.3W	702	31	28.5	13 21	10.4	26 14	24.1	702	31	28.5	11 01	22.0	30 22	26.3	704	31	02.3	30 22	-12.9	26 14	-02.2
42010	29.7N	093.4W	573	27	28.3	02 22	09.5	24 15	21.3														
42011	29.6N	093.5W	373	19	29.9	02 23	09.7	24 14	22.8														
44003	40.8N	068.5W	720	31	16.9	26 09	08.4	11 23	12.5	726	31	15.6	01 01	12.6	31 17	14.3	722	31	03.1	28 09	-06.3	11 22	-01.8
44005	42.7N	068.3W	721	31	16.0	24 01	06.1	11 20	11.5	721	31	14.5	02 19	10.7	31 13	12.5	721	31	04.4	24 01	-06.5	11 20	-01.0
44006	36.3N	075.4W	719	31	24.0	01 19	11.1	24 21	16.5	680	31	21.9	01 20	15.4	31 18	17.9	719	31	04.4	26 18	-09.2	03 13	-01.4
45001	48.0N	087.6W	721	31	09.2	17 07	-03.2	23 23	04.5	721	31	06.8	05 22	04.9	26 10	05.6	721	31	03.5	31 18	-08.3	23 23	-01.0
45002	45.3N	086.3W	719	31	12.9	13 21	-01.0	24 02	07.4	719	31	11.2	01 01	07.3	27 09	08.9	719	31	03.5	31 07	-08.4	24 02	-01.5
45003	45.3N	082.8W	719	31	11.0	14 02	-00.4	24 11	06.5	718	31	10.4	01 10	05.0	26 07	07.1	719	31	02.9	16 15	-06.5	02 01	-00.7
45004	47.2N	086.5W	720	31	10.2	13 22	-03.0	24 04	05.0	720	31	06.8	01 01	04.8	26 09	05.6	720	31	04.0	13 22	-08.1	24 04	-00.6
45005	41.7N	082.5W	718	31	19.0	01 14	02.1	24 12	10.9	718	31	16.4	01 18	10.6	29 12	13.1	718	31	04.8	20 22	-09.0	24 12	-02.2
45006	47.3N	090.0W	719	31	10.2	14 13	-02.2	21 12	05.4	715	31	06.9	07 18	05.0	25 09	05.9	719	31	04.7	31 05	-07.9	21 12	-00.5
45007	42.7N	087.1W	719	31	17.9	01 08	01.0	24 10	09.9	719	31	15.3	01 07	08.8	21 15	11.0	719	31	04.7	06 08	-09.2	24 10	-01.0
45008	44.3N	082.4W	721	31	13.6	01 15	00.9	24 12	08.3	721	31	14.0	01 01	07.2	21 04	10.2	721	31	03.1	16 05	-07.2	24 10	-01.9
46001	56.0N	148.0W	712	31	11.4	11 19	00.1	30 15	07.8	712	31	10.7	01 12	07.4	30 17	09.2	712	31	01.9	11 20	-08.0	05 11	-01.4
46002	42.5N	130.0W	720	31	18.2	05 17	10.0	28 18	14.7	720	31	18.1	01 01	15.7	30 11	16.7	720	31	01.0	05 17	-06.0	28 18	-02.0
46003	52.0N	156.0W	716	31	11.7	23 13	01.9	30 17	08.3	720	31	11.0	03 02	08.4	31 08	10.0	720	31	01.6	23 11	-06.6	29 20	-01.7
46004	51.0N	136.0W	723	31	13.0	17 02	06.8	29 01	10.6	723	31	12.7	01 01	10.4	31 12	11.5	723	31	01.5	17 02	-04.0	29 01	-00.9
46005	46.0N	131.0W	721	31	16.3	01 01	09.0	27 10	12.7	698	31	15.3	01 11	11.6	22 00	14.1	721	31	02.6	22 00	-04.7	27 10	-01.3
46006	40.7N	137.7W	701	31	21.0	01 01	12.7	27 00	16.9	722	31	17.8	04 01	15.4	29 13	16.7	722	31	04.1	18 00	-03.7	27 00	00.1
46010	46.2N	124.2W	722	31	16.5	23 00	09.0	30 02	12.5	722	31	15.8	03 23	12.9	24 09	14.3	722	31	02.6	23 00	-05.4	04 12	-01.8
46011	34.9N	120.9W	719	31	17.8	01 23	10.4	22 17	14.0	719	31	16.3	31 22	12.5	26 03	14.4	719	31	02.1	01 16	-03.7	20 16	-00.4
46012	37.4N	122.7W	722	31	17.2	31 22	09.9	22 18	12.9	723	31	14.2	02 02	12.1	28 04	12.9	723	31	03.9	31 22	-02.9	22 18	-00.1
46013	38.2N	123.3W	719	31	17.5	31 22	08.5	23 17	12.3	719	31	14.2	31 21	10.0	05 12	11.9	719	31	03.3	31 22	-03.7	23 17	00.3
46014	39.2N	124.0W	718	31	16.3	31 20	10.5	13 15	13.6	718	31	16.7	31 21	11.7	04 13	14.9	718	31	02.6	01 01	-04.9	23 12	-01.4
51001	23.4N	162.3W	716	31	27.0	11 18	22.3	26 20	25.5	717	31	28.0	12 03	25.7	29 17	26.5	717	31	00.4	11 18	-03.8	26 20	-01.0

OCTOBER 1981			PRESSURE (MB)							WIND SPEEDS (KNOTS)				MEAN WIND SPEED (KNOTS)								
BUOY	LAT	LONG	OBS	DAYS	MAX	DY HR	MIN	DY HR	MEAN	OBS	MAX	DY HR	DIR	N	NE	E	SE	S	SW	W	NW	TOTAL
41002	32.3N	075.3W	720	31	1029.9	21 14	1006.3	02 23	1018.9	718	29	14 20	030	15.2	16.5	11.0	8.7	10.1	13.2	11.5	14.8	13.5
41003	30.3N	080.4W	719	31	1027.1	20 16	1008.5	02 22	1018.3	719	27	31 17	030	15.7	13.5	9.3	9.2	12.4	10.7	11.3	10.3	12.1
41004	32.6N	078.7W	720	31	1029.0	20 16	1005.6	02 21	1018.6	403	25	24 10	020	13.2	15.9	6.3	7.3	14.2	13.6	12.2	11.9	13.8
41005	31.7N	079.7W	722	31	1027.9	20 15	1006.7	02 21	1018.3	721	27	31 13	030	13.3	15.8	8.2	7.9	10.3	11.5	10.2	11.2	12.5
42001	25.9N	089.7W	700	31	1025.2	20 16	1009.9	25 21	1017.0	698	27	24 05	040	11.8	12.5	11.3	7.7	11.6	8.9	8.3	9.8	11.0
42002	26.0N	093.5W	720	31	1025.6	19 16	1007.3	25 21	1016.4	720	27	24 01	020	13.2	13.1	10.7	10.2	10.3	12.9	13.7	15.7	11.2
42003	26.0N	086.0W	723	31	1023.4	20 16	1010.9	25 09	1016.5	723	26	26 20	300	10.9	10.7	10.0	9.9	10.2	4.8	3.3	8.4	10.3
42007	30.1N	088.9W	456	20	1027.8	20 15	1007.6	25 22	1018.2	456	28	25 21	130	15.4	14.4	12.5	9.4	7.5	8.1	12.3	12.5	12.0
42008	28.7N	095.3W	702	31	1030.2	19 16	1006.8	25 20	1017.1	704	32	18 12	350	19.2	12.6	11.7	13.7	14.1	13.4	12.8	18.7	14.2
42010	29.7N	093.4W	574	27	1030.4	19 15	1006.2	25 20	1017.9	564	31	23 16	020	15.1	11.3	10.5	11.1	9.8	12.3	4.9	14.6	11.6
42011	29.6N	093.5W	373	19	1027.0	20 16	1011.3	09 23	1017.2	374	33	23 16	030	15.2	16.0	11.7	12.2	11.2	9.3	4.9	3.4	12.4
44003	40.8N	068.5W	720	31	1035.5	31 15	995.2	08 08	1017.7	722	25	19 23	270	16.1	13.8	13.3	12.9	11.7	12.4	15.0	17.0	14.2
44005	42.7N	066.3W	721	31	1038.3	31 14	991.3	08 05	1017.4	721	33	01 01	270	15.4	12.9	11.9	10.4	15.5	16.1	17.2	18.3	15.3
44006	36.3N	075.4W	719	31	1031.1	20 16	1002.8	02 12	1019.1	718	29	24 07	330	19.8	17.8	7.5	9.3	14.4	12.8	12.1	16.0	15.6
45001	48.0N	087.6W	720	31	1030.8	21 16	984.5	16 10	1017.7	687	28	18 12	270	11.4	12.8	11.8	11.5	6.0	7.9	11.7	10.9	10.8
45002	45.3N	086.3W	719	31	1030.5	12 14	983.6	16 12	1019.1	716	30	18 21	310	11.1	5.3	6.4	6.8	11.1	13.0	9.4	15.2	11.0
45003	45.3N	082.8W	719	31	1031.3	13 17	987.5	18 18	1018.5	719	33	18 23	280	9.4	6.8	8.6	8.0	11.3	12.4	14.0	14.4	11.1
45004	47.2N	086.5W	720	31	1030.6	21 16	981.7	16 11	1017.8	719	32	18 14	330	13.9	9.1	9.3	11.0	12.1	15.0	7.8	14.7	12.2
45005	41.7N	082.5W	718	31	1031.2	13 15	994.9	16 10	1019.5	646	34	18 19	190	9.7	11.4	12.9	11.6	14.4	17.0	17.1	15.8	13.7
45006	47.3N	090.0W	719	31	1032.6	21 16	990.3	16 06	1018.4	716	21	18 10	340	7.9	6.6	8.6	7.5	6.8	9.3	7.8	9.6	08.3
45007	42.7N	087.1W	719	31	1029.0	22 03	993.1	18 06	1019.6	719	27	18 19	300	10.0	7.1	7.9	10.6	11.2	12.5	15.5	13.7	11.0
45008	44.3N	082.4W	721	31	1032.4	13 17	988.7	18 12	1019.6	721	27	07 07	310	13.0	8.6	9.1	9.9	14.6	15.1	17.2	18.3	13.1
46001	56.0N	148.0W	712	31	1028.8	19 20	980.8	26 14	1005.9	711	30	29 21	260	13.3	6.4	8.6	17.0	16.4	13.1	17.0	17.0	16.0
46002	42.5N	130.0W	720	31	1028.4	23 19	995.4	27 15	1017.0	720	27	05 16	220	12.8	13.3	7.3	11.0	18.4	17.5	15.7	14.7	14.5
46003	52.0N	156.0W	719	31	1031.1	25 05	966.3	30 19	1011.7	718	40	22 20	130	14.5	11.7	11.5	19.1	18.3	14.3	20.6	21.8	18.9
46004	51.0N	136.0W	723	31	1035.6	23 19	964.8	06 07	1012.0	723	34	06 18	080	14.8	16.6	15.6	15.5	17.9	13.5	15.1	15.1	15.3
46005	46.0N	131.0W	721	31	1032.1	23 19	987.8	05 21	1014.9	721	25	07 07	280	11.7	13.1	2.3	11.4	13.3	15.6	13.6	12.2	12.7
46006	40.7N	137.7W	722	31	1031.6	24 09	1001.7	27 12	1019.7	720	34	06 12	320	12.1	13.6	10.2	12.5	14.5	22.0	20.3	20.4	16.0
46010	46.2N	124.2W	722	31	1027.9	17 10	993.2	26 03	1016.1	721	33	06 01	180	10.8	7.8	8.7	7.2	16.7	13.0	5.7	8.0	11.3
46011	34.9N	120.9W	719	31	1023.1	31 19	1008.9	01 03	1015.2	612	24	30 02	330	9.6	6.2	3.9	5.7	7.1	6.4	7.9	12.4	10.4
46012	37.4N	122.7W	723	31	1026.1	30 17	1008.4	28 08	1016.7	721	24	28 05	160	6.4	6.1	2.7	9.5	9.0	6.0	5.9	8.9	08.1
46013	38.2N	123.3W	719	31	1027.9	30 19	1007.4	28 05	1017.3	719	27	27 18	140	3.1	2.2	5.0	10.6	9.2	6.7	8.0	10.9	09.2
46014	39.2N	124.0W	718	31	1027.6	30 19	1003.2	28 04	1016.0	717	34	27 18	150	8.5	3.5	4.6	11.1	12.2	8.1	6.0	11.3	09.2
51001	23.4N	162.3W	717	31	1020.9	21 20	1012.7	04 02	1016.9	717	25	27 18	050	10.8	14.0	13.6	8.5	7.2				13.4

NOVEMBER 1981			TOTAL FREQUENCY OF WIND SPEEDS (%)							TOTAL FREQUENCY OF WIND DIRECTIONS (%)							
BUOY	LAT	LONG	CALM	<4KT	4-10KT	11-21KT	22-33KT	34-47KT	>47KT	N	NE	E	SE	S	SW	W	NW
41001	34.7N	072.3W		0.3	9.9	43.8	42.6	0.7	1.4	17.2		0.7	1.5	4.4	11.6	35.2	29.4
41002	32.3N	075.3W	0.1	10.0	34.9	43.4	11.6			2.5	24.5	21.6	16.6	10.9	1.5	2.5	19.9
41003	30.3N	080.4W	0.1	2.8	31.3	57.1	6.9			14.7	8.0	15.7	7.4	3.4	12.2	15.3	18.5
41004	32.6N	078.7W	0.6	4.5	27.3	55.0	12.3	0.1		17.3	16.3	9.9	6.6	5.6	8.5	16.9	18.7
41005	31.7N	079.7W	0.1	2.6	31.7	55.5	10.1			17.4	11.2	14.7	6.8	4.7	10.5	15.3	19.5
42001	25.9N	089.7W	0.6	7.6	34.4	55.0	2.8			14.7	21.5	21.3	16.1	6.0	5.0	6.5	5.0
42002	26.0N	093.5W	0.8	10.6	42.7	44.2	2.5			23.6	14.8	7.0	22.1	17.2	8.2	2.1	5.1
42003	26.0N	086.0W	1.4	7.6	40.3	51.0	1.1			27.6	23.7	12.4	13.9	3.7	3.3	8.5	6.8
42007	30.1N	088.9W	0.1	8.0	41.2	48.3	2.5			16.6	14.9	20.4	10.0	13.3	7.5	7.9	9.5
42008	28.7N	095.3W		4.2	40.3	49.0	6.5			12.3	18.3	12.4	15.3	19.1	7.0	1.4	14.3
42010	29.7N	093.4W	2.0	6.8	51.5	40.0	1.7			22.9	16.3	12.3	18.4	14.0	3.6	5.4	7.2
44003	40.8N	068.5W	0.3	1.7	14.2	66.6	17.4			10.7	14.4	9.2	3.6	6.9	7.1	24.1	23.9
44005	42.7N	068.3W		1.9	13.6	50.4	33.6	0.3		13.1	17.0	7.6	2.1	7.6	12.6	18.6	21.3
44006	36.3N	075.4W	2.4	5.8	27.2	48.1	16.6	0.1		20.6	4.2	1.6	4.5	11.3	10.4	18.2	21.2
45001	48.0N	087.6W	0.4	6.7	47.2	45.2	0.6			2.2	2.7	8.0	22.9	18.4	10.0	25.1	10.7
45002	45.3N	086.3W	0.4	7.4	45.5	44.0	2.6			13.6	4.7	3.0	4.4	14.0	26.9	10.5	22.8
45003	45.3N	082.8W	2.0	9.1	43.0	43.2	4.7			5.0	6.2	3.5	8.3	13.0	14.7	23.8	25.5
45004	47.2N	086.5W	1.9	5.4	38.1	44.7	11.7			11.0	0.4		4.9	11.7	27.3	14.1	30.6
45005	41.7N	082.5W	7.7	16.6	34.6	43.7	5.2			0.4	8.0	20.3	19.3	26.4	17.1	4.3	4.1
45006	47.3N	090.0W	1.4	6.5	67.9	25.6				4.7	5.2	2.6	3.1	5.0	40.1	16.7	22.6
45007	42.7N	087.1W	0.4	6.3	55.8	34.0	3.9			10.9	8.6	8.3	14.2	15.1	12.4	11.7	18.7
45008	44.3N	082.4W	7.1	15.3	29.4	42.1	13.2			16.5	6.2	7.5	7.9	11.1	13.1	13.3	24.3
46001	56.0N	148.0W	0.1	4.1	27.6	42.2	25.5	0.6		8.5	11.1	13.2	15.5	9.2	15.1	21.9	5.7
46002	42.5N	130.0W	0.1	1.1	17.5	59.9	19.1	2.1	0.2	14.0	2.5	1.6	4.2	25.2	22.1	16.1	14.1
46003	52.0N	156.0W		0.6	2.8	36.5	49.6	10.4		15.1	6.4	4.2	3.9	10.2	16.5	19.1	22.5
46004	51.0N	136.0W	0.3	1.1	16.1	43.1	35.0	4.6		7.0	4.5	4.0	11.1	25.6	22.1	15.7	10.0
46005	46.0N	131.0W	0.7	4.6	23.2	53.2	16.5	4.4	2.1	1.5	4.0	5.0	7.3	20.6	25.5	20.8	15.1
46006	40.7N	137.7W		1.7	6.9	48.7	38.0	4.7		10.9	1.3	0.5	3.1	19.7	14.2	25.6	24.6
46010	46.2N	124.2W	0.4	5.9	23.3	59.2	10.4	1.1	0.1	6.5	6.8	19.6	12.2	34.0	13.4	3.2	4.0
46011	34.9N	120.9W	4.7	23.5	43.1	27.9	0.6			22.5	6.1	6.2	9.9	4.1	1.1	6.2	41.9
46012	37.4N	122.7W	2.5	16.0	46.0	35.0	2.9			11.5	5.6	5.1	20.0	26.5	7.3	4.4	19.6
46013	38.2N	123.3W	1.9	10.7	41.4	43.0	4.9			5.4	4.8	15.3	22.4	14.4	7.2	7.5	23.0
46014	39.2N	124.0W	0.8	6.5	37.7	45.3	7.8	0.7		14.5	7.8	10.8	21.7	25.8	6.0	2.7	10.7
46016	63.3N	170.3W		2.1	18.6	51.3	25.8	2.1		30.2	33.8	22.2	6.6	2.2	2.6		1.4
46017	60.3N	172.3W	0.4	3.0	15.6	60.6	20.7			27.8	25.3	15.6	6.6	9.9	3.4		11.3
46018	60.3N	177.0W			5.3	71.3	23.4			33.8	19.9				4.5	16.2	25.5
46019	57.2N	170.3W		9.2	17.5	39.6	33.8			28.3	9.3	7.1	14.4	5.3	13.6	11.7	10.3
46020	55.9N	168.0W			20.6	44.5	34.4	0.5		13.5	4.6	8.5	11.1	8.6	13.5	13.9	26.3
46021	57.7N	160.0W			22.8	53.4	24.3	1.6		13.4	17.6	18.9	14.2	5.6	6.9	7.9	16.5
51001	23.4N	162.3W	0.6	1.3	27.3	57.7	13.5	0.3		7.8	62.1	28.2	0.5	0.1	0.7		0.5

NOVEMBER 1981			% FREQUENCY OF WIND SPEEDS (<4 KTS)								% FREQUENCY OF WIND SPEEDS (4-10 KTS)								% FREQUENCY OF WIND SPEEDS (11-21 KTS)							
BUOY	LAT	LONG	N	NE	E	SE	S	SW	W	NW	N	NE	E	SE	S	SW	W	NW	N	NE	E	SE	S	SW	W	NW
41001	34.7N	072.3W					0.2	0.1			0.2		3.2	0.1		1.1	4.4	4.0	7.8		0.2	0.4	3.8	7.4	14.3	17.9
41002	32.3N	075.3W	1.1		0.3	0.6	3.4	1.3	1.5	1.8	1.0	11.7	10.4	3.0	4.7	0.2	0.4	3.0	0.4	7.0	10.1	12.8	2.8		0.3	10.1
41003	30.3N	080.4W	0.4	<.05	0.3	0.6	0.5	0.3	0.6	0.1	5.5	2.4	2.2	5.6	1.4	7.1	5.3	5.9	11.6	5.3	12.8	1.2	1.6	6.5	7.8	10.3
41004	32.6N	078.7W	0.6	0.5	0.5	0.7	0.4	0.5	0.6	0.7	3.6	2.5	5.0	3.7	3.8	0.7	3.5	4.6	10.2	9.6	4.4	2.4	1.5	5.4	10.3	11.9
41005	31.7N	079.7W	0.3	0.6	1.2	0.1		0.4		0.2	3.1	5.0	4.3	4.0	4.0	1.6	3.6	6.0	11.1	3.6	9.2	2.7	0.6	6.4	9.8	11.8
42001	25.9N	089.7W	0.2	1.2	1.6	1.3	0.4	0.5	1.2	1.4	1.7	8.9	10.1	5.0	3.0	7.0	2.7	<.05	12.1	11.4	9.0	10.9	4.2	1.5	2.5	3.7
42002	26.0N	093.5W	1.0	1.8	2.2	2.1	1.0	1.8	0.7	<.05	9.2	9.6	3.7	8.4	4.3	5.7	1.1	0.5	12.6	3.2	1.0	11.0	10.6	0.7	0.3	4.6
42003	26.0N	086.0W	0.8	1.8	0.9	1.3	0.8	0.6	1.3	0.1	11.4	8.2	6.5	6.9	2.5	1.7	2.3	0.8	15.5	12.7	4.9	5.8	0.3	0.9	4.9	6.0
42007	30.1N	088.9W	1.0	1.1	0.9	0.9	0.5	0.1	2.2	1.3	4.2	6.6	7.6	6.8	5.7	7.9	4.6	7.9	10.2	7.0	11.7	2.3	7.1	4.5	1.2	4.3
42008	28.7N	095.3W	0.1	0.7		1.2	0.1	1.2	0.2	0.7	3.6	8.3	6.7	5.7	6.6	4.8	0.9	4.1	7.0	9.3	5.4	8.5	11.9	1.3	0.3	5.5
42010	29.7N	093.4W	1.2	1.2	0.4	0.7	0.7	0.3	1.4	1.0	10.6	9.7	7.5	9.2	5.8	2.8	3.6	2.1	10.1	5.7	4.5	8.4	7.5	0.5	0.3	3.5
44003	40.8N	068.5W	0.4	0.7	0.4	0.1	0.1	0.2	0.1		1.9	2.4	1.1	1.9	1.8	1.5	1.4	2.3	5.4	9.1	7.5	1.5	4.6	5.0	17.7	15.8
44005	42.7N	068.3W	0.4	0.7	0.1		0.1	<.05	0.1	0.5	2.2	2.9	2.5	0.9	1.1	0.6	1.8	1.5	5.2	7.4	1.6	0.4	5.6	9.6	12.0	8.2
44006	36.3N	075.4W	0.8	1.1		0.1	1.2	1.4	0.6	0.8	5.2	1.0	1.2	3.8	3.5	4.2	5.2	3.1	11.6	1.8	0.3	0.7	6.2	4.8	10.4	12.2
45001	48.0N	087.6W	0.6	2.2	0.4	2.8				0.8	1.6	0.5	5.4	9.3	14.0	7.2	7.0	2.7			2.0	10.7	4.4	2.8	18.1	7.3
45002	45.3N	086.3W	0.7	0.2	0.5	0.4	2.3	1.7	0.8	0.8	3.3	1.0	2.6	1.6	9.1	12.8	5.6	9.5	9.1	3.5		2.4	2.6	11.0	3.6	12.3
45003	45.3N	082.8W	0.6	0.5	1.6	0.4	1.5	1.8	1.7	0.7	2.5	3.5	1.6	4.6	9.1	6.8	9.5	5.3	1.9	2.2		3.3	2.4	5.5	9.0	18.9
45004	47.2N	086.5W	0.3			1.6	1.2	1.2	0.7	0.6	4.2	0.4		3.3	6.6	10.0	9.1	4.5	4.3				3.9	12.6	4.3	19.6
45005	41.7N	082.5W	0.4	2.7	3.2	4.5	2.7	1.8	0.9	0.4		2.5	8.3	10.8	7.2	3.7	1.0	1.0		2.8	8.4	3.8	14.9	9.2	1.9	2.7
45006	47.3N	090.0W	0.8	0.9	0.5	1.0	0.6	0.5	1.3	0.7	2.9	4.7	2.1	2.1	4.2	37.3	10.3	4.7	0.9					2.3	5.1	17.2
45007	42.7N	087.1W	0.9	0.8		0.2	1.5	1.2	0.9	0.6	7.3	5.2	4.5	7.9	10.5	7.2	6.0	7.3	1.7	2.7	3.9	5.7	3.1	3.9	4.2	9.0
45008	44.3N	082.4W	2.2	0.8	1.6	1.6	1.7	1.9	2.7	2.5	4.5	2.7	4.5	2.5	5.1	3.5	4.6	2.4	6.1	1.4	0.8	1.8	4.1	7.7	3.5	16.8
46001	56.0N	148.0W	0.8	1.1	1.0	0.7	0.4	0.1	0.1	0.3	3.1	6.3	7.2	4.3	0.9	1.8	2.9	1.1	3.6	1.3	3.1	4.4	4.6	9.7	11.7	3.6
46002	42.5N	130.0W	0.1	<.05		0.1		0.4	0.2	0.2	1.1	0.7	0.7	1.2	4.7	3.7	3.2	2.2	8.3	1.7	0.5	2.6	14.5	15.1	8.8	8.3
46003	52.0N	156.0W	0.3					0.1		0.1	0.6	0.8	0.6			0.6	0.2	<.05	6.0	4.9	3.2	0.6	3.8	6.3	4.1	7.6
46004	51.0N	136.0W	0.1	0.1			0.1	0.4	0.1	0.2	1.4	1.1	1.3	2.1	3.1	2.3	4.1	2.7	4.6	2.4	0.6	3.2	10.2	8.1	8.2	5.7
46005	46.0N	131.0W	0.1	0.4	1.0	1.4	0.2	0.2	0.9	0.4	0.1	2.2	3.3	2.2	2.9	6.0	4.3	2.1	0.3	0.8	0.6	3.0	15.0	16.2	12.2	5.1
46006	40.7N	137.7W	0.1	0.1	0.1	0.3	0.3	<.05	0.4	0.3	0.6	0.6	0.2	0.2	3.4	1.1	1.2	1.5	4.5	0.6	0.1	2.2	10.1	5.9	10.3	15.1
46010	46.2N	124.2W	0.9	0.8	0.7	0.6	0.5	1.0	0.6	0.8	1.4	3.4	3.6	5.6	5.7	2.4	0.7	0.6	4.2	2.6	13.4	5.0	21.8	7.8	1.8	2.5
46011	34.9N	120.9W	4.8	3.0	3.9	4.3	1.6	0.5	2.6	2.7	10.2	4.2	2.3	2.2	0.4	0.1	2.7	21.0	7.1	1.0		3.3	1.9	0.6	1.0	17.0
46012	37.4N	122.7W	2.2	0.8	2.6	2.2	3.6	2.0	1.0	1.2	6.2	3.3	2.3	9.9	9.6	3.8	1.9	8.8	3.0	1.6	0.1	7.2	10.7	1.5	1.5	9.6
46013	38.2N	123.3W	1.6	0.5	3.0	1.4	1.7	0.6	0.6	1.5	3.3	2.8	3.5	10.6	3.7	2.3	3.8	7.2	0.5	1.4	4.9	9.3	7.1	4.0	2.9	13.0
46014	39.2N	124.0W	1.4	1.3	2.3	1.7	0.9	0.2		0.7	7.5	6.2	7.9	4.3	4.4	2.0	1.6	3.8	5.5	0.3	0.7	11.8	17.8	3.1	1.1	5.0
46016	63.3N	170.3W	0.3	1.0	0.4	0.4					5.9	4.6	5.8	1.8	0.3	0.1		0.1	19.4	9.1	11.8	4.7	2.9	2.5		1.3
46017	60.3N	172.3W	0.4		0.3	0.5		0.4		1.3	2.5	1.4	3.3	0.4	3.0	2.1		3.0	19.3	14.7	8.5	3.4	7.0	0.8		7.1
46018	60.3N	177.0W									1.1	3.2						1.1	30.6	16.8				3.5	8.0	12.5
46019	57.2N	170.3W		0.4	0.4	1.0	3.8	2.0	1.1	0.4	1.6	0.5	0.7	4.6	1.3	3.2	2.6	2.6	10.0	4.0	2.8	6.3	3.3	6.8	4.8	4.7
46020	55.9N	168.0W									1.7	1.0	1.7	2.4	2.9	3.3	3.8	3.4	6.1	2.8	6.1	6.9	2.5	4.1	5.5	10.6
46021	57.7N	160.0W									2.5	2.7	4.0	4.0	2.6	1.0	3.8	2.2	5.7	11.7	8.5	8.2	2.6	5.6	1.9	9.7
51001	23.4N	162.3W		0.6	0.2		0.1	0.3			5.6	15.2	5.1	0.5		0.4		0.5	2.3	36.6	18.7	0.1				



DECEMBER 1981 | TOTAL FREQUENCY OF WIND SPEEDS (%) | TOTAL FREQUENCY OF WIND DIRECTIONS (%)

WBAN#	LAT	LONG	CALM	VAR	1-3KT	4-6KT	7-10KT	11-16KT	17-21KT	22-27KT	28-33KT	34-40KT	41KT	N	NE	E	SE	S	SW	W	NW
41001	34.7N	072.7W		2.1	2.5	12.6	18.3	41.5	5.2					13.2	8.3	5.0	4.5	20.3	8.4	11.5	30.8
41002	32.3N	060.4W		2.1	0.4	29.9	50.6	12.6						14.8	5.5	3.2	5.0	21.1	11.7	12.9	25.8
41004	32.6N	079.7W		0.1	2.9	22.6	63.5	12.0						20.6	15.2	4.5	4.3	5.9	13.2	17.4	18.9
41005	31.7N	079.7W			3.1	26.1	50.6	12.2						17.7	10.5	3.2	4.7	6.9	19.3	16.3	21.2
41006	29.9N	078.4W		2.2	2.9	29.9	57.2	10.1						13.7	19.3	17.9	16.3	22.0	7.0	1.5	2.3
41007	34.5N	077.4W		1.2	3.4	38.4	51.3	6.4						17.0	14.2	13.2	22.8	24.6	2.2	2.4	3.5
41008	31.4N	080.9W		1.0	2.2	34.6	50.6	9.4						19.2	15.2	10.2	21.2	17.4	6.2	3.4	7.1
41009	28.5N	080.2W		1.0	5.4	38.1	49.3	7.2						11.0	14.8	7.2	7.4	15.2	14.8	18.2	16.5
41010	28.9N	078.5W		1.0	3.7	29.5	50.5	16.3						21.6	21.5	10.1	12.5	16.1	7.4	1.6	7.2
41012	29.7N	080.6W			3.9	27.2	60.4	8.6						21.6	21.5	17.0	9.3	14.9	6.8	3.2	5.6
41013	29.4N	080.5W			2.2	20.0	65.5	12.3						19.5	27.3	12.8	8.8	20.7	5.5	2.7	2.6
44003	40.8N	068.5W		1.0	3.3	23.6	54.6	17.1	1.5					9.9	6.4	3.4	3.9	7.4	8.7	27.3	33.0
44005	42.7N	068.7W			2.3	16.3	44.6	28.4	6.9					16.5	8.0	5.2	6.2	6.4	9.0	24.3	24.5
44006	36.3N	075.4W		0.1	1.5	17.1	61.1	20.4						17.3	6.9	4.3	7.3	12.7	9.0	14.2	28.6
44008	41.2N	069.5W		1.5	4.4	34.5	49.6	11.7						4.5	7.2	2.5	9.6	21.7	23.4	13.0	18.0
44009	42.3N	067.1W			1.2	22.9	70.8	5.1						15.2	4.0	3.7	4.9	9.6	17.2	18.7	29.5
44011	56.0N	158.0W		0.1	4.7	18.9	58.1	21.4	1.3					6.7	5.7	9.6	16.5	6.3	15.0	20.1	18.8
44020	42.5N	130.0W		0.5	3.7	21.3	52.7	22.1	0.1					7.5	2.7	7.6	13.5	17.4	21.8	22.4	9.7
46003	52.0N	156.0W			1.1	1.7	41.6	36.8	7.6					13.2	4.1	7.1	13.4	7.3	9.7	30.5	23.7
46004	51.6N	136.0W			2.7	3.3	47.6	36.2	6.2					9.0	1.9	3.5	16.5	12.6	12.9	31.2	16.0
46005	46.1N	131.0W			1.6	12.6	45.0	34.6	5.2					4.3	3.4	5.6	12.6	14.0	16.4	27.2	16.6
46006	40.7N	137.7W			1.3	11.4	51.3	29.6	5.9	0.9				7.4	3.3	4.3	6.2	12.7	26.4	26.3	11.5
46011	34.9N	120.9W		0.1	2.1	17.9	51.6	18.9	0.7					7.6	2.6	29.3	10.6	16.3	11.2	12.8	11.5
46012	37.4N	122.7W				7.0	79.0	5.2						32.0	52.5						15.5
46013	38.2N	123.3W				7.0	79.0	5.2						32.0	52.5						15.5
46022	40.7N	124.5W		1.6	9.3	36.5	40.8	5.4						10.6	9.2	3.7	15.7	16.2	5.7	5.7	28.0
46023	40.8N	124.5W		1.4	8.4	37.6	39.7	9.7						8.0	2.9	1.6	10.2	12.0	10.2	9.7	35.2
46024	39.2N	123.7W		1.4	2.7	36.6	48.1	11.6						23.8	2.9	6.4	21.9	22.7	6.9	3.5	11.9
46025	33.7N	119.1W			3.2	24.2	42.7	29.9						7.5	10.8	18.0	17.7	15.2	17.8	8.0	1.9
46026	37.8N	122.5W		0.9	3.9	24.7	48.1	21.6	1.7					21.2	5.5	11.0	17.6	6.9	8.2	13.6	6.6
46028	35.7N	121.0W		0.4	2.4	24.4	52.7	16.8	1.7					7.3	15.6	8.7	7.4	6.6	17.7	7.2	16.0
46042	36.8N	122.4W			1.7	16.4	44.3	33.2	4.7					9.3	16.1	14.5	19.1	9.3	1.0	7.1	19.6
51001	23.4N	162.3W		3.5	9.1	19.7	43.7	7.5						7.6	42.4	13.2	9.2	8.5	3.0	9.1	7.3

DECEMBER 1981 | % FREQUENCY OF WIND SPEEDS 4-6 KTS | % FREQUENCY OF WIND SPEEDS 4-10 KTS | % FREQUENCY OF WIND SPEEDS 11-21 KTS

WBAN#	LAT	LONG	N	NE	E	SE	S	SW	W	NW	N	NE	E	SE	S	SW	W	NW	N	NE	E	SE	S	SW	W	NW
41001	34.7N	072.7W		0.2	0.4	0.5	0.5	0.4	0.3	0.4	1.4	1.0	1.1	1.0	1.3	1.7	2.2	2.9	6.9	3.4	3.2	2.7	5.5	3.9	1.3	10.4
41002	32.3N	060.4W	0.3	0.2	0.4	0.5	0.5	1.4	0.5	1.5	0.2	0.2	1.4	0.2	1.4	0.5	1.7	3.3	0.3	0.2	1.5	0.2	1.5	1.3	3.5	7.3	11.7
41004	32.6N	079.7W	0.3	0.2	0.4	0.2	0.7	0.5	0.4	0.2	0.4	0.2	1.4	0.2	1.4	0.2	1.7	3.3	0.3	0.2	1.5	0.2	1.5	1.3	3.5	7.3	11.7
41005	31.7N	079.7W	0.3	0.2	0.4	0.2	0.7	0.5	0.4	0.2	0.4	0.2	1.4	0.2	1.4	0.5	1.7	3.3	0.3	0.2	1.5	0.2	1.5	1.3	3.5	7.3	11.7
41006	29.9N	078.4W	0.3	0.2	0.4	0.2	0.7	0.5	0.4	0.2	0.4	0.2	1.4	0.2	1.4	0.5	1.7	3.3	0.3	0.2	1.5	0.2	1.5	1.3	3.5	7.3	11.7
41007	34.5N	077.4W	0.3	0.2	0.4	0.2	0.7	0.5	0.4	0.2	0.4	0.2	1.4	0.2	1.4	0.5	1.7	3.3	0.3	0.2	1.5	0.2	1.5	1.3	3.5	7.3	11.7
41008	31.4N	080.9W	0.3	0.2	0.4	0.2	0.7	0.5	0.4	0.2	0.4	0.2	1.4	0.2	1.4	0.5	1.7	3.3	0.3	0.2	1.5	0.2	1.5	1.3	3.5	7.3	11.7
41009	28.5N	080.2W	0.3	0.2	0.4	0.2	0.7	0.5	0.4	0.2	0.4	0.2	1.4	0.2	1.4	0.5	1.7	3.3	0.3	0.2	1.5	0.2	1.5	1.3	3.5	7.3	11.7
41010	28.9N	078.5W	0.3	0.2	0.4	0.2	0.7	0.5	0.4	0.2	0.4	0.2	1.4	0.2	1.4	0.5	1.7	3.3	0.3	0.2	1.5	0.2	1.5	1.3	3.5	7.3	11.7
41012	29.7N	080.6W	0.3	0.2	0.4	0.2	0.7	0.5	0.4	0.2	0.4	0.2	1.4	0.2	1.4	0.5	1.7	3.3	0.3	0.2	1.5	0.2	1.5	1.3	3.5	7.3	11.7
41013	29.4N	080.5W	0.3	0.2	0.4	0.2	0.7	0.5	0.4	0.2	0.4	0.2	1.4	0.2	1.4	0.5	1.7	3.3	0.3	0.2	1.5	0.2	1.5	1.3	3.5	7.3	11.7
44003	40.8N	068.5W																								
44005	42.7N	068.7W																								
44006	36.3N	075.4W		0.2	0.4	0.4	0.2				0.2	0.2	0.4	0.2	0.4	0.4	0.2	0.2	0.4	0.2	0.4	0.2	0.4	0.4	0.2	0.2	0.4
44008	41.2N	069.5W		0.2	0.4	0.4	0.2				0.2	0.2	0.4	0.2	0.4	0.4	0.2	0.2	0.4	0.2	0.4	0.2	0.4	0.4	0.2	0.2	0.4
44009	42.3N	067.1W																								
44011	56.0N	158.0W		0.2	0.4	0.4	0.2				0.2	0.2	0.4	0.2	0.4	0.4	0.2	0.2	0.4	0.2	0.4	0.2	0.4	0.4	0.2	0.2	0.4
44020	42.5N	130.0W	0.2	0.2	0.4	0.2	0.7	0.5	0.4	0.2	0.4	0.2	1.4	0.2	1.4	0.5	1.7	3.3	0.3	0.2	1.5	0.2	1.5	1.3	3.5	7.3	11.7
46003	52.0N	156.0W																								
46004	51.6N	136.0W																								
46005	46.1N	131.0W																								
46006	40.7N	137.7W																								
46011	34.9N	120.9W		0.2	0.4	0.4	0.2				0.2	0.2	0.4	0.2	0.4	0.4	0.2	0.2	0.4	0.2	0.4	0.2	0.4	0.4	0.2	0.2	0.4
46012	37.4N	122.7W	0.2	0.2	0.4	0.2	0.7	0.5	0.4	0.2	0.4	0.2	1.4	0.2	1.4	0.5	1.7	3.3	0.3	0.2	1.5	0.2	1.5	1.3	3.5	7.3	11.7
46013	38.2N	123.3W	0.2	0.2	0.4	0.2	0.7	0.5	0.4	0.2	0.4	0.2	1.4	0.2	1.4	0.5	1.7	3.3	0.3	0.2	1.5	0.2	1.5	1.3	3.5	7.3	11.7
46022	40.7N	124.5W	0.2	0.2	0.4	0.2	0.7	0.5	0.4	0.2	0.4	0.2	1.4	0.2	1.4	0.5	1.7	3.3	0.3	0.2	1.5	0.2	1.5	1.3	3.5	7.3	11.7
46023	40.8N	124.5W	0.2	0.2	0.4	0.2	0.7	0.5	0.4	0.2	0.4	0.2	1.4	0.2	1.4	0.5	1.7	3.3	0.3	0.2	1.5	0.2	1.5	1.3	3.5	7.3	11.7
46024	39.2N	123.7W	0.2	0.2	0.4	0.2	0.7	0.5	0.4	0.2	0.4	0.2	1.4	0.2	1.4	0.5	1.7	3.3	0.3	0.2	1.5	0.2	1.5	1.3	3.5	7.3	11.7
46025	33.7N	119.1W	0.2	0.2	0.4	0.2	0.7	0.5	0.4	0.2	0.4	0.2	1.4	0.2	1.4	0.5	1.7	3.3	0.3	0.2	1.5	0.2	1.5	1.3	3.5	7.3	11.7
46026	37.8N	122.5W	0.2	0.2	0.4	0.2	0.7	0.5	0.4	0.2	0.4	0.2	1.4	0.2	1.4	0.5	1.7	3.3	0.3	0.2	1.5	0.2	1.5	1.3	3.5	7.3	11.7
46028	35.7N	121.0W	0.2	0.2	0.4	0.2	0.7	0.5	0.4	0.2	0.4	0.2	1.4	0.2	1.4	0.5	1.7	3.3	0.3	0.2	1.5	0.2	1.5	1.3	3.5	7.3	11.7
46042	36.8N	122.4W	0.2	0.2	0.4	0.2	0.7	0.5	0.4	0.2	0.4	0.2	1.4	0.2	1.4	0.5	1.7	3.3	0.3	0.2	1.5	0.2	1.5	1.3	3.5	7.3	11.7
51001	23.4N	162.3W	0.2	0.2	0.4	0.2	0.7	0.5	0.4	0.2	0.4	0.2	1.4	0.2	1.4	0.5	1.7	3.3	0.3	0.2	1.5	0.2	1.5	1.3	3.5	7.3	11.7

DECEMBER 1981 | % FREQUENCY OF WIND SPEEDS 22- 33 KTS | % FREQUENCY OF WIND SPEEDS 34-47 KTS | % FREQUENCY OF WIND SPEEDS 48KT KTS

WBAN#	LAT	LONG	N	NE	E	SE	S	SW	W	NW	N	NE	E	SE	S	SW	W	NW	N	NE	E	SE	S	SW	W	NW
41001	34.7N	072.7W	2.4	1.7	0.5	0.7	12.4	2.4	7.5	15.4	0.5			7.1	0.4	0.4	0.5	0.2	1.4							
41002	32.3N	060.4W	0.3	1.5	1.2	0.5	1.7	1.3	2.7	9.6																
41004	32.6N	079.7W	2.4	1.4	0.2	1.1	0.4	0.7	4.3	3.0																
41005	31.7N	079.7W	2.4	1.4	0.2	1.1	0.4	0.7	4.3	3.0																
41006	29.9N	078.4W	4.3	2.1	0.3	0.3	0.5	1.2	2.1	1.1																
41007	34.5N	077.4W	4.3	2.1	0.3	0.3	0.5	1.2	2.1	1.1																
41008	31.4N	080.9W	4.3	2.1	0.3	0.3	0.5	1.2	2.1	1.1																
41009	28.5N	080.2W	4.3	2.1	0.3	0.3	0.5	1.2	2.1	1.1																
41010	28.9N	078.5W	4.3	2.1	0.3	0.3	0.5	1.2	2.1	1.1																
41012	29.7N	080.6W	4.3	2.1	0.3	0.3	0.5	1.2	2.1	1.1																
41013	29.4N	080.5W	4.3	2.1	0.3	0.3	0.5	1.2	2.1	1.1																
44003	40.8N	068.5W																								
44005	42.7N	068.7W																								
44006	36.3N	075.4W	2.2	0.2	0.2	1.4	0.4	0.9	2.2	1.8																
44008	41.2N	069.5W	4.5	2.3	0.2	0.2	1.1	0.5	1.1	1.1																
44009	42.3N	067.1W	4.5	2.3	0.2	0.2	1.1	0.5	1.1	1.1																
44011	56.0N	158.0W	4.3	2.1	0.3	0.3	0.5	1.2	2.1	1.1																
44020	42.5N	130.0W	4.3	2.1	0.3	0.3	0.5	1.2	2.1	1.1																
46003	52.0N	156.0W																								
46004	51.6N	136.0W																								
46005	46.1N	131.0W																								
46006	40.7N	137.7W																								
46011	34.9N	120.9W	4.3	2.1	0.3	0.3	0.5	1.2	2.1	1.1																
46012	37.4N	122.7W																								
46013	38.2N	123.3W																								
46022	40.7N	124.5W	4.3	2.1	0.3	0.3	0.5	1.2	2.1	1.1																
46023	40.8N	124.5W	4.3	2.1	0.3	0.3	0.5	1.2	2.1	1.1																
46024	39.2N	123.7W	4.3	2.1	0.3	0.3	0.5	1.2	2.1	1.1																
46025	33.7N	119.1W	4.3	2.1	0.3	0.3	0.5	1.2	2.1	1.1																
46026	37.8N	122.5W	4.3	2.1	0.3	0.3	0.5	1.2	2.1	1.1																
46028	35.7N	121.0W	4.3	2.1	0.3	0.3	0.5	1.2	2.1	1.1																
46042	36.8N	122.4W	4.3	2.1	0.3	0.3	0.5	1.2	2.1	1.1																
51001	23.4N	162.3W	4.3	2.1	0.3	0.3	0.5	1.2	2.1	1.1																

DECEMBER 1981 | WAVE HEIGHTS (METERS) | FREQUENCY OF WAVE HEIGHTS (%)

WBAN#	LAT	LONG	OBS	MAX	DY	HR	MEAN	SIM	1-1.5M	2-2.5M	3-3.5M	4-4.5M	5-6.5M	7-8.5M	9-10.5M	11.5M
41001	34.7N	072.7W	72+	6.6	05	16	2.6		20.6	17.7	14.5	20.4	6.3	0.1		
41002	32.3N	060.4W	726	9.4	16	20	3.5	11.0	56.4	24.5	6.7	1.6				
41004	32.6N	078.7W	736	5.6	31	21	1.8	5.9	43.6	34.2	17.1	1.4				
42.001	25.9N	089.7W	736	3.5	18	22	1.1	25.6	58.6	13.5	2.3					
42.002	26.0N	093.6W	733	3.5	16	13	1.3	19.5	49.9	27.7	3.2					
42.003	26.0N	088.0W	734	3.5	16	23	1.2	17.8	65.6	9.8	4.4					
44.001	40.8N	068.5W	734	8.0	06	19	2.8	5.5	23.1	30.1	27.5	17.6	7.7	0.6		
44.005	42.7N	068.7W	733	8.0	16	22	2.2	5.8	35.8	32.7	17.9	8.7	3.8	0.1		
44.009	41.7N	067.9W	323	2.6	01	05	0.8	45.5	51.4	4.0						
44.027	42.7N	067.1W	253	3.5	01	07	1.8	12.6	33.9	44.2	9.3					
44.011	56.0N	148.0W	629	13.5	01	02	5.7		7.1	22.7	36.3	21.0	7.6	5.3	1.7	
44.020	42.5N	130.0W	736	8.5	05	03	3.9		14.9	15.2	32.4	24.9	5.8	1.5		
46.006	51.3N	136.0W	734	9.0	01	14	4.2		3.4	8.0	17.6	36.7	16.6	2.4		
46.005	46.0N	131.0W	732	10.0	04	22	4.0		0.4	13.7	34.1	39.4	11.4	0.9	0.2	
46.006	40.7N	137.7W	704	9.0	26	15	3.9		4.4	17.6	25.9	45.1	7.0	1.5		
46.010	46.2N	124.2W	704	10.0	05	08	5.3		9.6	27.7	31.7	27.3	3.8	1.1	0.1	
46.011	34.9N	120.9W	24	2.5	01	03	2.1			0.0						
46.012	37.4N	122.7W	735	6.5	21	17	2.5		15.1	47.1	31.5	5.4	0.8			
46.013	38.2N	123.3W	722	9.5	06	14	2.8		5.8	41.4	46.3	6.3				
46.014	39.2N	124.0W	736	6.0	21	14	2.9		5.7	38.3	37.6	17.9	0.1			
51.001	23.4N	162.3W	735	5.4	06	03	3.1		0.1	25.8	43.4	29.8				

DECEMBER 1981			AIR TEMPERATURE (DEG C)							SEA TEMPERATURE (DEG C)							AIR-SEA TEMPERATURE DIFFERENCE (DEG C)						
BUOY	LAT	LONG	OBS	DAYS	MAX	DY HR	MIN	DY HR	MEAN	OBS	DAYS	MAX	DY HR	MIN	DY HR	MEAN	OBS	DAYS	MAX	DY HR	MIN	DY HR	MEAN
41001	34.7N	072.3W	732	31	21.7	02 17	04.4	10 10	14.0	733	31	21.1	01 15	18.3	31 06	19.5	733	31	01.1	24 04	-15.4	10 10	-05.5
41002	30.3N	080.4W	736	31	25.1	02 01	04.3	19 10	16.8	736	31	25.4	02 05	20.5	24 12	22.3	736	31	01.2	31 18	-18.2	19 10	-05.5
41004	32.6N	078.7W	736	31	24.0	02 06	02.6	20 19	13.7	736	31	23.9	15 15	18.6	11 08	21.4	736	31	01.6	02 09	-19.7	19 19	-07.7
41005	31.7N	079.7W	733	31	24.7	02 04	04.3	10 17	15.4	733	31	25.2	03 04	18.2	23 07	21.5	733	31	02.5	23 18	-16.8	19 22	-06.1
42001	25.9N	089.7W	736	31	26.4	01 20	15.4	19 12	23.0	736	31	25.1	01 01	21.7	21 22	23.8	736	31	02.1	31 07	-07.5	19 12	-00.8
42002	26.0N	093.5W	735	31	25.7	01 04	15.3	19 03	21.8	735	31	25.5	01 04	22.8	24 07	23.7	735	31	00.8	22 19	-08.1	19 03	-02.0
42003	26.0N	086.0W	736	31	26.6	01 20	13.8	20 01	21.9	736	31	27.4	01 18	25.1	27 22	26.2	736	31	00.0	26 15	-12.0	20 01	-04.3
42007	30.1N	088.9W	223	10	22.3	01 01	08.9	05 15	15.6	223	10	20.2	01 17	16.6	09 15	18.0	223	10	03.1	01 01	-08.5	05 15	-02.4
42008	28.7N	095.3W	469	21	22.7	12 23	02.5	16 14	16.5	466	21	20.4	05 03	16.7	20 21	18.8	725	21	03.7	21 08	-15.2	18 14	-00.2
42010	29.7N	093.4W	730	31	21.6	20 19	01.2	19 15	13.5														
42011	29.6N	093.5W	364	16	19.7	29 02	01.7	19 14	11.7														
44003	40.8N	068.5W	735	31	13.7	02 21	-02.3	20 08	05.4	735	31	10.7	01 08	06.7	31 12	08.3	735	31	04.3	23 20	-09.8	20 08	-02.9
44005	42.7N	068.3W	736	31	12.4	16 07	-04.1	20 16	04.9	736	31	08.8	02 18	06.8	31 23	08.0	736	31	04.4	16 07	-11.8	20 16	-03.6
44006	36.3N	075.4W	733	31	16.7	02 12	-02.2	20 14	06.6	733	31	11.7	01 15	07.1	23 04	09.3	733	31	05.6	24 02	-10.8	20 14	-02.7
45005	41.7N	082.5W	325	14	09.5	02 00	-04.1	10 15	01.8	325	14	06.1	01 03	02.6	14 20	04.5	325	14	03.7	02 00	-07.8	09 13	-02.7
45007	42.7N	087.1W	253	11	08.7	01 16	-01.6	09 18	02.6	253	11	07.3	01 01	06.4	08 19	06.8	253	11	01.1	01 16	-08.2	09 18	-04.2
46001	56.0N	148.0W	686	31	06.8	16 20	-05.9	06 08	02.8	685	31	05.6	01 01	04.4	30 07	04.9	686	31	01.8	16 20	-11.0	06 06	-02.1
46002	42.5N	130.0W	736	31	15.0	19 02	07.1	26 14	11.2	736	31	17.9	02 20	11.4	24 03	12.0	736	31	03.2	19 07	-04.5	10 07	-00.9
46003	52.0N	156.0W	722	31	06.1	22 13	-04.0	05 12	02.9	725	31	06.7	01 01	05.3	30 08	05.8	726	31	00.4	22 13	-09.9	05 17	-02.8
46004	51.0N	136.0W	732	31	09.6	17 18	01.5	31 19	06.4	736	31	08.7	01 01	06.6	31 06	07.4	736	31	07.1	17 18	-06.0	05 17	-01.1
46005	46.0N	131.0W	734	31	12.5	01 02	04.5	31 09	08.8	736	31	12.6	01 01	10.9	30 05	11.7	736	31	00.1	16 20	-06.6	31 09	-02.9
46006	40.7N	137.7W	703	31	17.1	01 19	05.1	09 17	12.7	717	31	13.9	01 01	12.2	31 12	13.0	719	31	03.4	01 19	-08.1	09 17	-00.4
46010	46.2N	124.2W	729	31	13.9	09 10	03.4	31 19	08.7	726	31	13.7	10 02	09.0	31 04	12.1	733	31	01.0	09 10	-07.4	12 09	-03.5
46011	34.9N	120.9W	024	01	14.5	01 22	12.3	01 15	13.3	024	01	14.1	01 01	13.6	01 07	13.9	024	01	00.4	01 22	-01.5	01 15	-00.6
46012	37.4N	122.7W	735	31	15.4	06 22	10.2	28 18	12.8	735	31	14.1	07 23	12.4	26 11	13.3	735	31	01.4	16 06	-03.2	05 20	-00.6
46013	38.2N	123.7W	735	31	14.4	26 20	09.2	05 14	12.2	735	31	13.8	14 23	11.9	31 16	12.9	735	31	01.3	16 08	-03.7	05 14	-00.7
46014	39.2N	124.0W	735	31	15.9	16 06	08.3	23 13	12.2	735	31	13.8	09 21	12.4	31 04	13.1	735	31	01.9	16 06	-04.3	23 13	-00.9
46016	63.3N	170.3W	157	25	00.1	07 21	-19.7	06 00	-09.1														
46017	60.3N	172.7W	239	31	02.7	26 21	-14.0	16 00	-04.5														
46019	57.2N	170.3W	245	31	05.7	06 06	-08.3	04 18	-00.2														
46021	57.7N	160.0W	243	31	07.8	13 17	-14.2	05 08	-02.6	244	31	03.7	01 05	00.2	11 05	01.2	244	31	01.5	13 17	-16.7	05 08	-03.9
51001	23.4N	162.3W	735	31	24.7	01 02	18.7	25 02	22.9	735	31	24.6	01 01	23.5	27 16	23.9	736	31	02.6	23 03	-05.0	25 02	-01.0

DECEMBER 1981			PRESSURE (MB)							WIND SPEEDS (KNOTS)					MEAN WIND SPEED (KNOTS)								
BUOY	LAT	LONG	OBS	DAYS	MAX	DY HR	MIN	DY HR	MEAN	OBS	MAX	DY	HR	DIR	N	NE	E	SE	S	SW	W	NW	TOTAL
41001	34.7N	072.3W	732	31	1029.7	31 07	1007.3	05 10	1015.5	731	42	05	14	340	18.0	16.0	13.4	14.7	22.9	16.0	21.3	22.5	20.1
41002	30.3N	080.4W	736	31	1029.1	21 04	1007.0	15 19	1018.8	732	32	17	02	300	11.2	13.3	12.6	11.3	14.1	13.0	14.2	14.3	13.4
41004	32.6N	078.7W	736	31	1029.1	21 04	1007.0	15 18	1017.4	735	33	15	18	260	13.2	14.9	10.3	14.6	15.6	14.6	17.0	15.2	14.7
41005	31.7N	079.7W	733	31	1029.5	22 16	1007.4	15 17	1018.2	733	33	15	17	230	11.4	14.6	10.7	13.8	13.2	13.6	15.2	15.2	13.8
42001	25.9N	089.7W	736	31	1030.0	19 16	1009.7	01 08	1016.8	736	26	15	00	270	17.1	12.8	9.7	11.6	14.9	16.5	9.1	19.2	13.0
42002	26.0N	093.5W	735	31	1029.1	19 16	1005.3	22 21	1017.0	735	31	14	21	340	14.7	12.5	10.1	11.8	12.9	9.5	7.7	13.3	12.3
42003	26.0N	086.0W	736	31	1027.5	20 16	1010.2	01 20	1018.2	735	24	15	11	250	14.4	9.7	8.6	11.5	12.7	12.6	11.5	13.9	11.9
42007	30.1N	088.9W	223	10	1029.7	05 15	1004.7	01 08	1020.7	223	28	08	14	330	16.9	14.7	9.6	3.1	13.8	11.8	9.4	17.0	12.6
42008	28.7N	095.3W	725	31	1034.0	18 16	1003.7	22 14	1018.7	725	29	23	07	340	17.9	14.6	12.6	12.4	13.8	7.9	9.1	15.0	14.2
42010	29.7N	093.4W	730	31	1037.6	19 16	1004.0	01 00	1018.3	724	30	20	20	100	16.1	14.4	13.1	12.0	12.2	10.0	9.0	13.3	13.5
42011	29.6N	093.5W	364	16	1032.9	19 16	1007.5	22 19	1018.6	365	29	20	22	110	17.7	17.1	17.1	11.0	13.0	8.7	8.3	11.4	15.0
44003	40.8N	068.5W	735	31	1033.6	31 15	976.8	06 12	1010.8	733	36	06	10	310	13.6	17.5	11.5	11.5	15.6	14.4	16.1	15.8	15.3
44005	42.7N	068.3W	736	31	1033.6	31 14	974.5	06 18	1010.0	736	46	16	17	230	16.2	19.7	16.8	16.4	20.1	19.2	19.3	19.4	18.6
44006	36.3N	075.4W	731	31	1032.7	31 00	995.9	15 23	1014.8	732	32	05	22	330	15.4	12.5	12.2	13.1	15.0	12.6	18.5	18.3	15.9
45005	41.7N	082.5W	325	14	1027.8	13 16	994.5	02 00	1016.4	325	27	01	13	160	12.6	9.7	15.0	11.2	13.3	11.3	11.8	16.8	12.8
45007	42.7N	087.1W	253	11	1028.9	05 16	990.5	01 18	1014.9	253	24	01	06	100	14.6	10.7	17.7	16.7	13.6	13.2	11.3	15.4	14.1
46001	56.0N	148.0W	687	31	1021.5	26 06	961.1	01 01	948.6	686	37	16	13	280	9.5	11.9	17.5	16.2	13.4	16.6	17.5	17.5	16.0
46002	42.5N	130.0W	736	31	1038.4	22 02	964.8	19 01	1013.2	736	35	19	02	310	12.5	14.6	15.0	16.6	16.4	16.8	15.9	13.7	15.7
46003	52.0N	156.0W	725	31	1031.9	30 21	947.5	16 18	1002.1	722	42	05	16	300	18.2	19.9	14.7	16.8	15.3	20.6	24.8	22.6	20.3
46004	51.0N	136.0W	736	31	1024.4	21 12	964.0	04 17	1008.1	736	45	04	11	110	25.5	25.2	23.8	27.1	19.0	16.6	20.2	20.9	21.4
46005	46.0N	131.0W	736	31	1032.8	21 20	970.1	19 03	1010.0	736	45	17	22	200	12.5	18.0	18.9	21.2	21.9	24.1	20.3	17.1	19.6
46006	40.7N	137.7W	718	31	1036.4	21 20	986.1	16 08	1013.0	717	56	20	12	310	14.7	17.0	14.6	16.8	19.6	21.0	19.7	21.5	19.4
46010	46.2N	124.2W	732	31	1032.0	22 06	991.9	19 07	1014.2	672	36	05	06	170	9.1	8.4	16.2	14.9	20.8	16.4	14.1	13.9	16.1
46011	34.9N	120.9W	024	01	1024.3	01 08	1020.1	01 23	1023.1	020	22	01	00	340	13.5	12.2						16.3	13.3
46012	37.4N	122.7W	735	31	1029.1	22 18	1005.7	31 23	1020.3	735	26	19	00	150	9.5	8.7	3.9	11.9	13.0	8.9	8.5	13.4	11.2
46013	38.2N	123.3W	735	31	1030.0	22 18	1006.1	31 23	1020.8	735	31	21	19	310	3.8	5.9	11.7	12.8	14.6	9.0	11.7	16.2	13.1
46014	39.2N	124.0W	735	31	1029.8	22 19	1004.0	31 21	1019.2	735	31	09	12	150	12.3	6.8	7.1	16.1	15.6	11.9	12.2	13.2	13.5
46016	63.3N	170.3W	157	25	1028.6	26 15	969.9	18 12	1002.1	157	32	08	06	180	11.0	18.5	17.0	19.3	20.1	13.5	10.0	4.7	16.6
46017	60.3N	172.3W	239	31	1027.1	29 09	970.7	18 06	1002.5	232	37	08	00	180	15.1	21.2	21.1	20.9	18.8	12.1	16.4	8.9	16.8
46019	57.2N	170.3W	245	31	1037.6	29 09	968.0	22 06	1003.4	245	40	12	03	070	18.5	19.1	28.3	15.5	8.8	14.0	13.3	15.7	16.9
46021	57.7N	160.0W	068	09	1030.4	07 20	968.6	01 02	1002.0	232	37	05	23	320	16.8	22.3	15.7	13.4	11.8	17.6	23.4	21.9	19.1
51001	23.4N	162.3W	735	31	1025.7	06 20	1005.5	25 16	1016.7	735	28	08	00	030	12.6	15.6	11.6	8.5	12.0	10.4	13.1	6.7	12.8

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